# Appendix H

# Background Technical Memorandum

The laboratory analytical reports and the data validation reports are provided in Appendix I.

# Technical Memorandum

# Background Concentrations of Metals and Organochlorine Pesticides for use in the Fort Buchanan RCRA Facility Investigations

## U.S. Army Garrison
## Fort Buchanan, Puerto Rico

*Prepared for*

U.S. Army Environmental Command
San Antonio, TX
Contract No. W91ZLK-04-D-0015

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EA-R-252009

Final Version
December 2011
Project No. 61917.35

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### Figures and Tables

**Attachments**

# 1 INTRODUCTION

Resource Conservation and Recovery Act (RCRA) Facility Sites Investigations (RFIs) are ongoing at Fort Buchanan, Puerto Rico with the involvement of Fort Buchanan, the U.S. Army Environmental Command (AEC), the U.S. Environmental Protection Agency (EPA), and the Puerto Rico Environmental Quality Board (EQB). All parties have agreed that the establishment of background comparison values for metals and pesticides in soil would facilitate the delineation of the extent of RCRA-related concentrations of these constituents in soil. To this end, background samples were collected (EA 2011) and this memorandum was prepared to document the statistical derivation of the background comparison values, and to present the final, agreed upon values.

## 1.1 PURPOSE OF BACKGROUND COMPARISON VALUES

The objectives of the Fort Buchanan RFIs include characterization of potential contaminants of concern in surface soil, subsurface soil, surface water, sediment, and groundwater at specific sites, and the preparation of baseline risk assessments for human and ecological receptors in order to support decisions regarding the need for further investigation or action at the sites. Part of the RFI is delineation of the nature and extent of constituents present in media as a result of RCRA-regulated activities. However, chemicals may be present in soil, sediment, and water at Fort Buchanan from activities other than those regulated by RCRA and which are not the focus of RCRA investigations. These other sources are commonly referred to as "background sources," and the characterization of background concentrations as separate from RCRA-related concentrations is a common practice standardized by EPA guidance (USEPA 1989, USEPA 1992).

Many metals are expected to be present as background because they are a natural component of minerals in soil. Metals and organic compounds such as Polycyclic Aromatic Hydrocarbons (PAHs) may also be present as background due to aerial deposition of vehicle exhaust and runoff from asphalt road surfaces (Teaf 2008). Pesticides such as DDT, dieldrin, chlordane, and pentachlorophenol are likely to be present as background because they were sprayed or applied in the past as part of agricultural practices in Puerto Rico, and are very persistent (Shen et al 2005, Fernandez et al 2007); they may also be present due to Army pest control policies, which included spraying areas where personnel may come in contact with insect pests (USAEC 2007).

It is important to differentiate between chemical concentrations associated with RCRA related activities and those present as background because this is consistent with EPA guidance (USEPA 1989, USEPA 1992) and is essential to responsible allocation of time, effort, and funding. It also bears specific relevance for interpretation of risk assessment results. Many toxicological comparison benchmarks used in risk assessment are based on highly toxic or soluble forms of chemicals. Natural forms of metals in soil minerals are usually found in much less toxic, insoluble forms. Pesticides and other organic chemicals from ubiquitous sources are often bound

to material in soils and less bioavailable than the forms used to develop benchmarks. Thus benchmarks may overestimate risks and comparison of site concentrations to background concentrations provides an important indicator of whether assessment results may be overly conservative.

The purpose of this technical memorandum is to utilize the best available information to characterize the types and concentrations of chemicals expected to be found in Fort Buchanan soils. Section 2.0 discusses background concentrations of metals; Section 3.0 discusses background concentrations of pesticides.

# 2 METALS

Many metals may be found in soil as part of naturally occurring minerals. The soils of Puerto Rico are distinct in that they may contain naturally occurring concentrations of metals, especially arsenic, that are higher than those found in many other soils. This is because the geology of Puerto Rico is dominated by igneous and sedimentary rock formations that may contain concentrations of arsenic higher than those found in many other soils.

There are many circumstances where arsenic can occur naturally; for instance, arsenic is associated with hydrothermally altered rocks and with forest fires. Because Puerto Rico contains high rainfall, high topographic relief, and highly fractured rocks, minerals are carried down slope through erosion and settle in low lying areas. Fort Buchanan is located in a low lying area and two-thirds of the surface lithology is alluvial deposits that have received sediments from arsenic bearing rocks and processes.

In addition to the above natural processes that can lead to elevated concentrations of arsenic, arsenic, copper, and other metals may also be found widespread throughout soils due to their past use in pesticides. Antimony and lead may be found in soils due to deposition from car exhaust in the past when they could be found in leaded gasoline.

It is important to determine expected background concentrations which are composed of both natural and ubiquitous man-made (anthropogenic) inputs of chemicals specific to a given region and time period so that these can be distinguished from RCRA source contributions (Salminen and Tarvainen 1997). This section examines background concentrations of arsenic and other metals.

## 2.1 REGIONAL GEOLOGY AND MINERALOGY

Regional geology surrounding and within Fort Buchanan has been characterized in two main U.S. Geologic Survey (USGS) studies (Monroe 1973 and Pease 1977). The subsurface geology of Fort Buchanan is characterized by volcanic and sedimentary formations that span the full geologic past of Puerto Rico. A range of limestone outcrops, known as Montes de Caneja, occurs along the northern boundary of Fort Buchanan, and a second ridge, which is part of the same formation, forms the southern boundary. The North Coast limestone aquifer system

underlies Fort Buchanan and 700 square miles that extend eastward from western to northeastern Puerto Rico. The aquifer's extent is limited by the saltwater interface on the coastal side, landward thinning, and eventual absence of the limestone formations.

At Fort Buchanan, these limestones have been mostly eroded, existing only as isolated mogotes. Mogotes are comprised of eroded sedimentary limestone, and appear mostly as rounded hills within Caribbean islands. Eroded material (called alluvium) forms part of the soils around the mogotes. Unconsolidated deposits of Coastal Plain alluvium consisting of sands, silts, and clays characterize the surficial geology of Fort Buchanan. The Coastal Plain alluvium forms a relatively level valley in the central portion of the installation. Figures 1 and 2 present the geologic formations and soil types present at Fort Buchanan. Soil types present at the Fort Buchanan are described in the following paragraphs:

> *Almirante Series* – Almirante soils are in coastal plains and in valleys between the limestone hills (haystacks or mogotes). They formed in fine textured sediments of mixed origin. They are known locally as coastal plains clays or tertiary clays (NRCS 2003).
> *Soller Series* – The Soller series consists of shallow, well drained, moderately permeable soils on side slopes and hilltops in the humid limestone area. They formed in materials that weathered from limestone (NRCS 2002a).
> *Tanama Series* – Tanama soils consists of shallow, well drained, moderately permeable soils formed in materials weathered from limestone. They are gently sloping to very steep soils on foot slopes and side slopes of limestone hills (NRCS 2000).
> *Vega Alta* – The Vega Alta series consists of very deep, well drained, moderately permeable soils on uplands and terraces. They formed in clayey, iron-rich coastal plain sediments (NRCS 2004).
> *Vega Baja* – Vega Baja soils consists of very deep, somewhat poorly drained, slowly permeable soils on alluvial fans and coastal plains. They formed in alluvial sediments and the underlying coastal plain sediments (NRCS 2002b).

All of these soils contain limestones or clays which may be naturally high in certain metals. Certain metals are known to occur at naturally elevated concentrations in limestone in Puerto Rico. These include aluminum, magnesium, arsenic, and vanadium. Of particular concern is arsenic.

Studies of soils found in Puerto Rico have shown that arsenic is naturally present in higher concentrations than other regions due in part to the country's arsenic-rich limestone and carbonate geological deposits. The major source of arsenic in sediments and soils of this region is the weathering of arsenic-enriched rocks in the upland areas (BB&L 2004). Arsenic has been found in the soils of Puerto Rico at natural concentrations up to and exceeding 22 mg/kg (BB&L 2004) and, in general, has been found to occur in volcanic rock at an average of 2-3 mg/kg and as high as 100 mg/kg (Waldron 1980; Boyle and Jonasson, 1973). Background studies have

been performed for other RCRA and Superfund sites in the same geographic region as Fort Buchanan. These include studies for:

- The RCA Del Caribe Site in Barceloneta, where off-site average background concentrations of arsenic were determined to be 45.5 mg/kg (BB&L 2004).
- The Barceloneta Landfill Site, where off-site background concentrations of arsenic range from 0.4 to 117 mg/kg, with a 95% upper confidence limit of the mean (UCLM) of 64.2 mg/kg (BB&L 2004).

Overall, these studies suggest that metals are naturally higher in the soils of Puerto Rico, with typical background concentrations of arsenic in the Coastal Plains province averaging between 22 and 65 mg/kg. This indicates that human and ecological screening levels for arsenic may overestimate risks.

## 2.2 SITE SPECIFIC STUDY TO CHARACTERIZE METALS IN BACKGROUND

In 2007, the Army directed and conducted a site-specific study of metals concentrations in background areas at Fort Buchanan to characterize metal concentrations that could be anticipated in areas not influenced by releases from chemical sources. Table 1 presents a summary of sample locations and the location description including historic activities. Sample locations are presented in Figure 3. As described in Table 1, land use in the sampled areas has varied little since the 1960s.

### 2.2.1 Study Design

Thirty soil samples and three duplicates were collected from areas of the installation where historic activities were not expected to result in any chemical releases to the environment. Samples were collected from the surface (0-0.5 ft bgs) using a hand auger and were analyzed for TAL metals using methods SW846 6010B and SW846 7471A.

It should be noted that a number of the sites addressed in the Site Wide RFI for Fort Buchanan are covered with asphalt or concrete. Soil samples were collected from below this layer to minimize potential impacts from the paving materials; thus the sample depths of those samples suggest that the soil is not at the surface. However, these samples were treated as surface soil in the RFI and therefore it is appropriate for their data to be compared to the background comparison values developed in this memorandum.

### 2.2.2 Data Reduction

Chemical analytical data were reviewed and results prepared for statistical analyses using methods standard to EPA protocols. Analytical results bearing the U or UJ qualifier, indicating that the analyte was not detected at the given reporting limit, were retained in the data set and considered non-detects. Each analyte was assigned a numerical value equal to its detection limit (metals) or reporting limit (pesticides and herbicides) for statistical purposes.

If duplicate samples were collected or duplicate analyses were conducted on a single sample, the following guidelines were employed to select the appropriate sample measurement:

- If both samples/analyses showed that the analyte was present, the average of the two detected concentrations was retained for analysis, based on conservative professional judgment;
- If both samples/analyses were not detected, the average of the two detection or reporting limit concentrations was retained for analysis; and
- If only one sample/analysis indicated that the analyte was present, it was retained for analysis and the non-detect value was discarded.

### 2.2.3 Statistical Analyses

Statistical analyses were performed through the use of the EPA ProUCL program version 4.00.04 (USEPA 2009). Summary statistics were produced for each metal for which results were available. The raw data and summary statistics are provided in Attachment 1. Summary statistics included determination of the frequency of detection, minimum detect, maximum detect, average based on detected values or, for non-detects, the method detection limit (MDL), and the 95% Upper Prediction Limit (95% UPL) of the mean.

Statistical analyses included an outlier analysis and the calculation of 95% UPLs without inclusion of outliers. The soil background dataset was evaluated using graphical and statistical procedures to determine the existence of outliers. Quantile plots, including regression lines, were generated to graphically detect the presence of outliers and provide information about the distribution of the dataset including non-detect observations (Attachment 2, as mentioned above the MDL was used for non-detects). Suspected outliers were identified in the quantile plots through visual examination of values significantly exceeding the trendline of theoretical quantiles. Outlier determination from quantile plots is subjective. Therefore, data sets with at least 5 detected values were further evaluated using the Rosner Test at the 99% significance level (this evalution was completed after identification of the datasets' distributions).

Goodness-of-fit (GOF) tests were used to identify deviations from assumed data distributions at the 95% significance level (Attachment 3). For GOF tests, the MDL was substituted for non-detect observations. Distributions were tested in the following order: normal (Shapiro-Wilk W test), lognormal (Shapiro-Wilk W test), and gamma (Anderson-Darling test). For data sets with at least 5 detected results, suspected outliers identified on the quantile plots were further evaluated using the Rosner Test ($n \geq 25$) under the assumed data distribution identified with the GOF evaluation. The Rosner tests were computed with EPA's ProUCL software program (Attachment 4) to evaluate suspected outliers in the dataset at the 99% significance level. The option to replace the non-detects with one-half the MDL values was used in the outlier evaluation because there is no option for a nonparametric outlier test in ProUCL.

Based on evaluation of the quantile plots, no suspected outliers were identified for beryllium, calcium, copper, manganese, potassium, selenium, sodium, and thallium (Table 2 and Attachment 2). The Rosner Test was run for all metals with suspected outliers except antimony and silver, which had insufficient detections for the evaluation. Based on the results of the quantile and Rosner Tests, potential outliers were identified for nine metals: antimony, cadmium, cobalt, lead, magnesium, mercury, nickel, silver, and zinc.

The potential outliers were removed from the dataset for all further statistical evaluations. The 95% UPLs were computed using ProUCL after removing potential outliers and assigning an appropriate theoretical data distribution to the sample data. The nonparametric Kaplan-Meier (KM) 95% UPL was used for data sets with non-detect observations (Attachment 5).

For a normal distribution, the 95% UPL for a single observation was computed as

$$UPL = \bar{x} + t_{.05,(n-1)} s \sqrt{\frac{1}{n} + 1}$$

where $\bar{x}$ and $s$ are simple arithmetic mean and standard deviation obtained using the background data, and $t_{.05,(n-1)}$ is the one-tailed Student's $t$ critical value evaluated at $\alpha = .05$ with ($n$-1) degrees of freedom.

For a lognormal distribution, the UPL was calculated as

$$UPL = \exp\left[ \bar{y} + t_{.05,(n-1)} s_y \sqrt{\frac{1}{n} + 1} \right]$$

where $\bar{y}$ and $s_y$ are simple arithmetic mean and standard deviation obtained using the log-transformed background data $y_i = \ln(x_i)$.

For a nonparametric distribution in data sets without non-detects, the 95% percentile was used as an estimator for the 95% UPL. For a nonparametric distribution in data sets with non-detects, the KM 95% UPL was used. The KM estimator does not use substitution methods for handling non-detects; rather it is based upon a statistical distribution function estimate adjusted for the frequency and level of non-detects. In order to use the KM test in ProUCL, non-detects were entered at the MDL with a flag indicating that the value is a non-detect.

All statistical computations were conducted with ProUCL (Attachment 5).

### 2.3 SELECTION OF RECOMMENDED COMPARISON VALUE

Results of the site-specific background study for metals at Fort Buchanan are presented in Table 3. The 95% UPL for a single independent observation was used for the comparison value. In cases where a 95% UPL could not be calculated with the dataset that excluded outliers

(antimony, selenium, silver, and thallium), the maximum detected value of non-outlier results was used as the comparison value. The maximum MDL was selected for antimony, because it was only detected in one sample, and that result was identified as an outlier. It should be noted that average concentrations were calculated with outliers included; thus the high values of the outliers pulled the average "up". Outliers were not included during selection of background comparison values; therefore, there are some instances where the background comparison value is less than the average concentration.

Of particular note are background values for arsenic, chromium, and thallium, which are higher than human health screening levels, and aluminum, arsenic, chromium, copper, iron, manganese, selenium, thallium, vanadium, and zinc, which are higher than ecological screening values. This indicates that these screening values may be of limited relevance for the site given naturally occurring concentrations of metals.

# 3 PESTICIDES

Organochlorine pesticides (OCPs) are often detected at low levels widespread in soils. Chlorinated pesticides, or OCPs, were introduced in the 1940s and include individual pesticides such as endosulfan, chlordane, aldrin, dieldrin, mirex, and DDT and its breakdown products DDD and DDE. Even with the ban of OCPs in many countries in the 1970s, residues are often detected in soils due to their environmental persistence and use in some undeveloped areas of the world. OCPs typically have low solubility and high soil adsorption coefficients (Barbash et al. 1996). Because of these attributes, OCPs degrade slowly and have the potential to remain in the environment long after application and in organisms long after exposure.

OCPs are transported throughout geographic regions via atmospheric deposition, surface/ground water runoff, and persistence in soils contaminated from past applications. Studies have shown that concentrations of these pesticides tend to be higher near harbors, ports, industrial areas, and the outfalls of major rivers (which characterize the greater San Juan metropolitan area), but that they are still found in areas notably distant from obvious pollution sources. This indicates that long-range transport and deposition is an active transport pathway (Fernandez et al 2007, Shen et al 2005, Bidleman 1999). OCPs have been detected in a wide range of habitats in isolated areas (George and Frear 1966, Bidleman and Olney 1974, Clausen and Berg 1975), validating preliminary theories of large-scale distribution and deposition to areas far from the original site of application.

Pesticides have been found at concentrations above screening levels in soil and sediment at Fort Buchanan. The specific pesticides identified as Chemicals of Potential Concern (COPCs) are DDT, DDD, DDE, dieldrin, pentachlorophenol, and gamma-chlordane. In general, OCPs such as these have been used as insecticides for crops, termiticides for wood structures, for the control of vector born diseases, and in a variety of household and commercial applications (Shen et al 2005, Fernandez et al 2007). DDT has specifically been used for malaria control (Shen et al 2005, Wong et al 2008), and it is notable that a malaria control ditch is present on Fort Buchanan in the vicinity of the sites addressed in the RFI. This indicates that application of DDT has occurred at Fort Buchanan, and that detections of DDT, DDD, and DDE in soil and sediment can be expected.

## 3.1 SITE SPECIFIC STUDY TO CHARACTERIZE PESTICIDES BACKGROUND

In 2011, the Army directed and conducted a site-specific study of OCP concentrations in background areas at Fort Buchanan to characterize pesticide concentrations that could be anticipated in areas not influenced by releases from chemical sources. Table 1 presents a summary of sample locations and the location description including historic activities. Sample locations are presented in Figure 1.

### 3.1.1 Study Design

Twelve soil samples and one duplicate were collected from areas of the installation where specific pesticide-related historic activities (such as storage or mixing) did not occur. Samples were collected from the surface (0-0.5 ft bgs) using a hand auger and were analyzed for organochlorine pesticides (method SW846 8081A) and herbicides (method SW846 8151A, to measure pentachlorophenol). The sample design and methods is described further in the work plan (EA 2011).

### 3.1.2 Data Reduction

Chemical analytical data were reviewed and results prepared for statistical analyses using methods standard to EPA protocols and as described in Section 2.2.2.

### 3.1.3 Statistical Analyses

Statistical analyses were performed through the use of the EPA ProUCL program version 4.00.04 (USEPA 2009). Summary statistics were produced for each pesticide for which results were available. The raw data and summary statistics are provided in Attachment 6. Summary statistics included determination of the frequency of detection, minimum detect, maximum detect, average based on detected values or, for non-detects, the reporting limit, and the 95% UPL of the mean.

Statistical analyses included an outlier analysis and the calculation of 95% UPLs without inclusion of outliers. The soil background dataset was evaluated using graphical and statistical procedures to determine the existence of outliers. Quantile plots, including regression lines, were generated to graphically detect the presence of outliers and provide information about the distribution of the dataset including non-detect observations (Attachment 7, as mentioned above the reporting limit was used for non-detects). Suspected outliers were identified in the quantile plots through visual examination of values significantly exceeding the trendline of theoretical quantiles. Outlier determination from quantile plots is subjective. Therefore, data sets with at least 5 detected values were further evaluated using the Dixon Test at the 99% significance level (this evalution was completed after identification of the datasets' distributions).

Goodness-of-fit (GOF) tests were used to identify deviations from assumed data distributions at the 95% significance level (Attachment 8). For GOF tests, the reporting limit was substituted for non-detect observations. Distributions were tested in the following order: normal (Shapiro-Wilk W test), lognormal (Shapiro-Wilk W test), and gamma (Anderson-Darling test). For data sets with at least 5 detected results, the suspected outliers identified on the quantile plots were further evaluated using the Dixon Test ($n < 25$) under the assumed data distribution identified with the GOF evaluation. The Dixon tests were computed with EPA's ProUCL software program (Attachment 9) to evaluate suspected outliers in the dataset at the 99% significance level. The option to replace the non-detects with one-half the reporting limit values was used in the outlier evaluation because there is no option for a nonparametric outlier test in ProUCL.

Based on evaluation of the quantile plots, one suspected outlier was identified for each pesticide (Table 4 and Attachment). The Dixon Test was run for DDE and DDT; all other pesticides had insufficient detections for the evaluation. Based on the results of the quantile plots and Dixon Test, potential outliers were identified for each pesticide.

The potential outliers were removed from the dataset for all further statistical evaluations. The 95% UPLs were computed using ProUCL after removing potential outliers and assigning an appropriate theoretical data distribution to the sample data. The non-parametric KM 95% UPL was used for data sets with non-detect observations (Attachment 10).

For a normal distribution, the 95% UPL for a single observation was computed as

$$UPL = \bar{x} + t_{.05,(n-1)} s \sqrt{\frac{1}{n} + 1}$$

where $\bar{x}$ and $s$ are simple arithmetic mean and standard deviation obtained using the background data, and $t_{.05,(n-1)}$ is the one-tailed Student's $t$ critical value evaluated at $\alpha = .05$ with ($n$-1) degrees of freedom.

For a lognormal distribution, the UPL was calculated as

$$UPL = \exp\left[ \bar{y} + t_{.05,(n-1)} s_y \sqrt{\frac{1}{n} + 1} \right]$$

where $\bar{y}$ and $s_y$ are simple arithmetic mean and standard deviation obtained using the log-transformed background data $y_i = \ln(x_i)$.

For a nonparametric distribution in data sets without non-detects, the 95% percentile was used as an estimator for the 95% UPL. For a nonparametric distribution in data sets with non-detects, the KM 95% UPL was used. The KM estimator does not use substitution methods for handling non-detects; rather it is based upon a statistical distribution function estimate adjusted for the frequency and level of non-detects. In order to use the KM test in ProUCL, non-detects were entered at the reporting limit with a flag indicating that the value is a non-detect.

All statistical computations were conducted with ProUCL (Attachment 10).

### 3.2 SELECTION OF RECOMMENDED COMPARISON VALUE

Results of the site-specific background study for Fort Buchanan are presented in Table 5. The 95% UPL for a single independent observation was used for the comparison value for DDE and DDT. For all other pesticides, the maximum reporting limit was selected as the comparison value because the pesticides were only detected in one sample, and those results were identified as outliers. It should be noted that the average concentrations were calculated with outliers

included, thus the high values of the outliers pulled the averages "up". Outliers were not included during selection of background comparison values; therefore, the background comparison values are less than the average concentrations.

## 4 SUMMARY

Part of a RFI is delineation of the nature and extent of RCRA-regulated sources of chemicals, but chemicals may also be present in soil, sediment, and water from sources other than those regulated by RCRA. It is important to differentiate between chemical concentrations associated with RCRA related sources and those present as background because this is consistent with EPA guidance (USEPA 1989, USEPA 1992). It also bears specific relevance for interpretation of risk assessment results.

Soils in Puerto Rico are expected to have some metals in higher naturally occurring concentrations than other regions due in part to the country's arsenic-rich deposits and carbonate geological deposits. Pesticides are also expected to be present in background because they were sprayed or applied in the past as insecticides, termiticides, and to control vector born diseases in areas such as the malaria control ditch that traverses Fort Buchanan. Background concentrations of compounds can be determined from the collection of samples in a site-specific background study, as was done for metals and pesticides at Fort Buchanan.

The site-specific background data were evaluated to identify the 95% UPLs of the dataset. These 95% UPLs are presented in Tables 3 and 5 and will be used as comparison values in the Fort Buchanan RFI.

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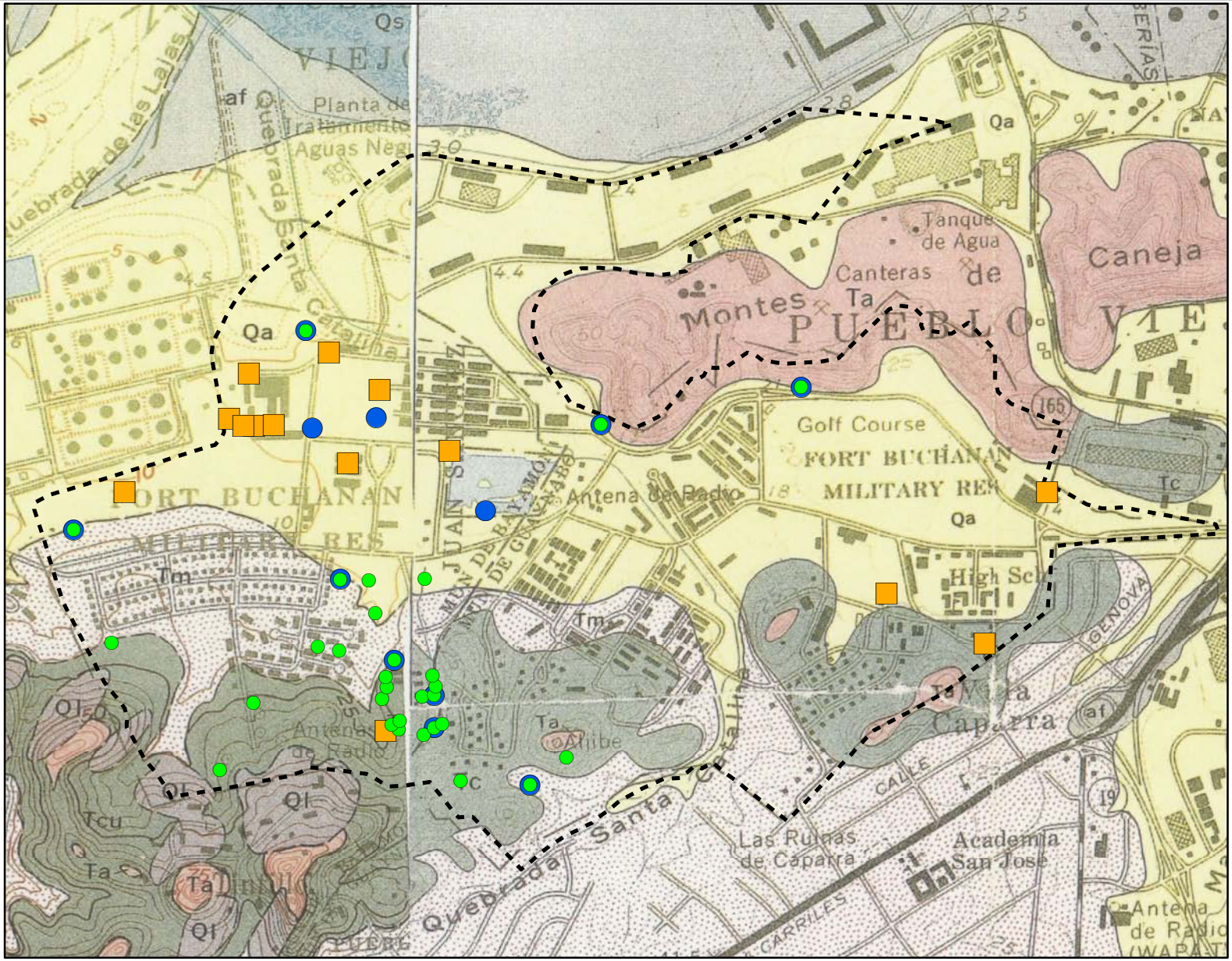
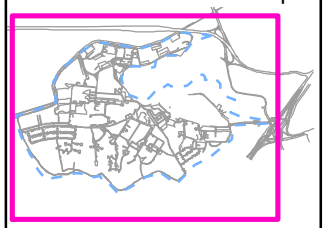



Area Shown in Main Map



## Legend

- Soil Sample-- Metals Analysis
- Soil Sample-- Pesticide/Herbicide Analysis
- RFI Site
- Installation Boundary

**Geology:**
Qa = Alluvium
Ql = Landslide Deposits
TA = Aguada Limestone
Tcu = Cibao Formation
Tm = Mucarabones Sand

Source: USGS Bayamon Quadrangle, 1973 and San Juan Quadrangle, 1977.

0 200 400
Meters

N

EA Engineering, Science, and Technology

# Fort Buchanan, Puerto Rico

Figure 1
Geologic Formations and Background Soil Sample Locations at Fort Buchanan

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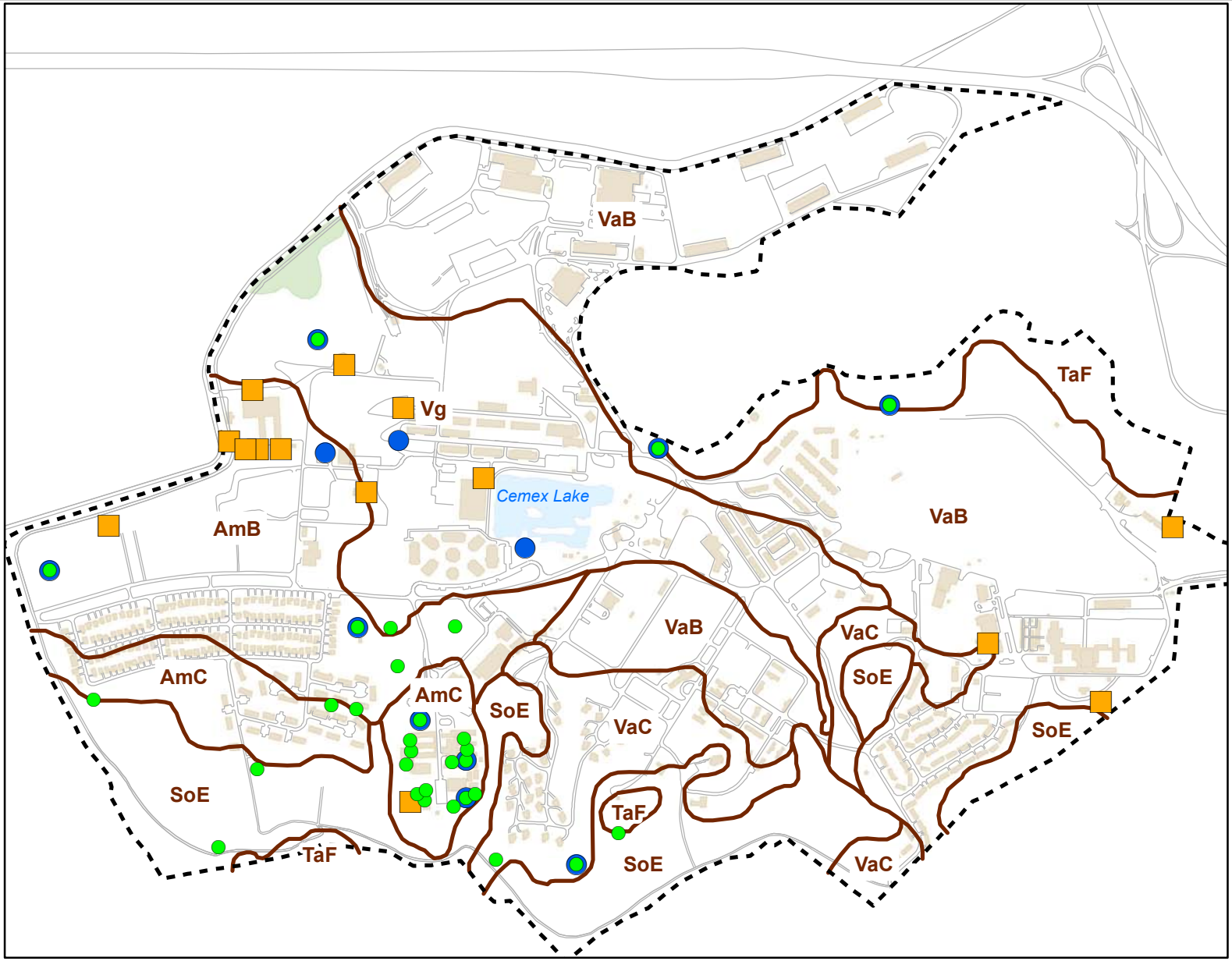
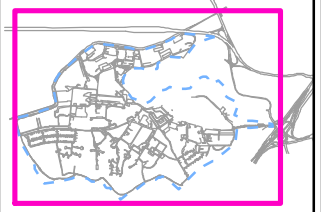



Area Shown in Main Map



## Legend

- Soil Sample-- Metals Analysis
- Soil Sample-- Pesticide/Herbicide Analysis
- RFI Site
- Installation Boundary
- Soil Type Boundary
- Roads
- Buildings
- Wetlands
- Water

Soil Key and % Slope
AmB = Almirante, 2-5%
AmC = Almirante, 5-12%
SoE = Soller, 20-40%
TaF = Tanama, 20-6-%
VaB = Vega Alta, 2-5%
VaC = Vega Alta, 5-12%
Vg = Vega Baja, 0-2%

Source: Fort Buchanan Soil Survey, Nov. 2002

0 175 350
Meters

N

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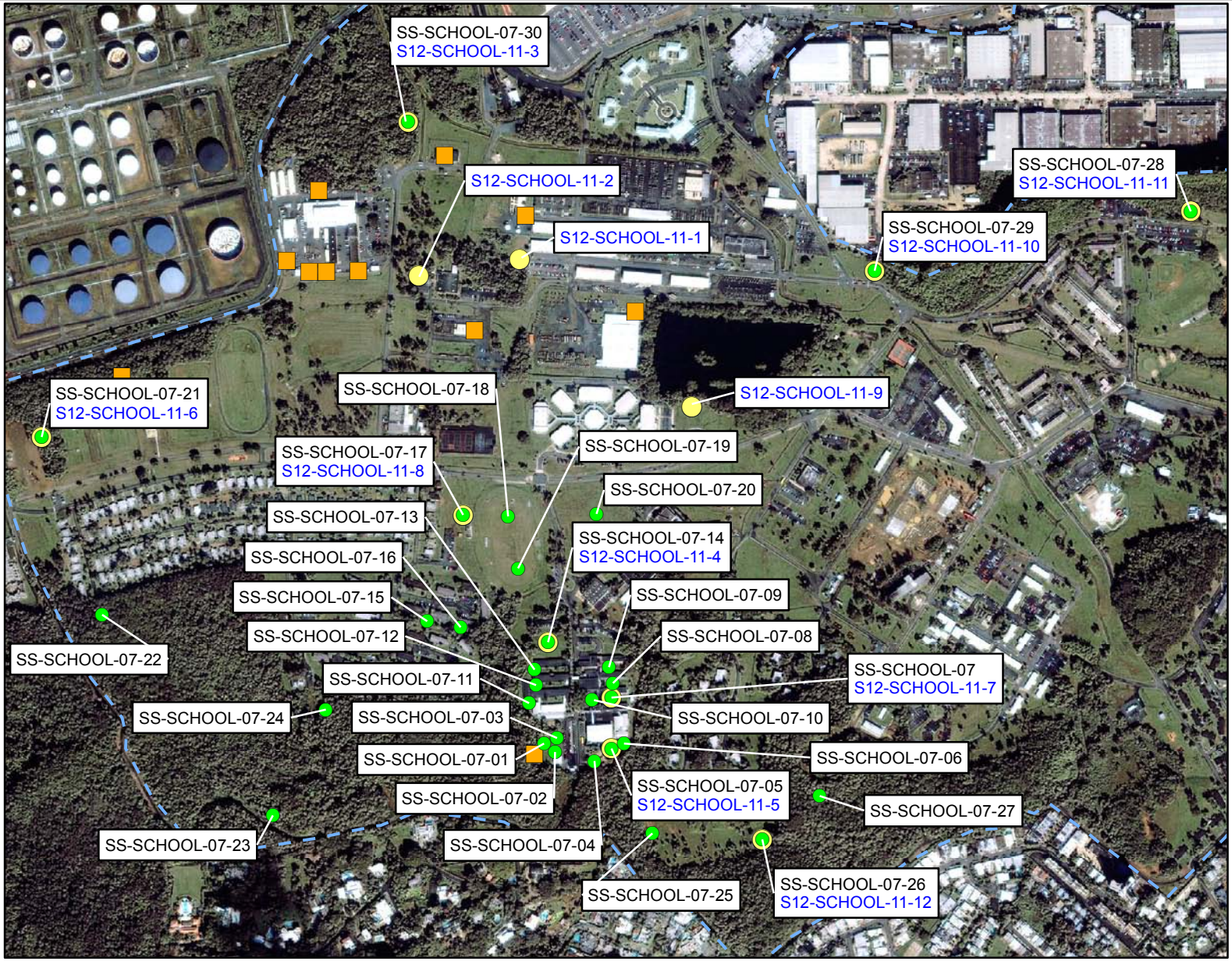
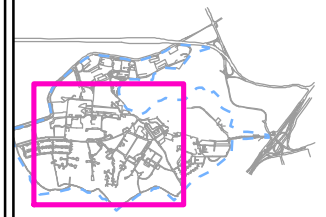
# Fort Buchanan, Puerto Rico

Figure 2
Soil Types and Background Soil Sample Locations at Fort Buchanan

\\Edgewoodfp\projects\Universal GIS\Buchanan\MXDs\BkgMemo_soil_types_samp_locs.mxd




Area Shown in Main Map



## Legend

- Soil Sample-- Metals Analysis
- Soil Sample-- Pesticide/Herbicide Analysis
- RFI Site
- Installation Boundary

Sample names presented in black font are the ones used during the metals investigation.

Sample names presented in blue font are the ones used during the pesticides/ herbicides investigation.

Aerial Photo from 2006.

0 125 250
Meters

N

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# Fort Buchanan, Puerto Rico

Figure 3
Background Sample Locations

\\Edgewoodfp\projects\Universal GIS\Buchanan\MXDs\RFI MXDs\RFI_bkg sample locs.mxd

Table 1
Selection of Background Sample Locations

| Background Location | Location Description | Geology | Soil Type (Order) | Analysis Groups |
|---|---|---|---|---|
| SS-SCHOOL-07-01 | Historic aerial photos suggest this area was undisturbed until the late 1970s or early 1980s. In a 1981 photograph the area is cleared and by 1991 the area appears to be a grassy field adjacent to the schools. There is no evidence of industrial or commercial activity at the area, or of significant modifications to the ground surface via the addition of fill or the removal of soil. These locations are likely characteristic of native soils that have been minimally impacted (with respect to potential chemical hazards) by human activity. However, as the area is maintained as a playing field, there is the potential that some pesticides and/or herbicides have been used since the 1980s as part of typical grounds maintenance activities. Since the collection of the 2007 background samples, modular classrooms have been placed on this field. | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-02 | | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-03 | | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-04 | These locations are in or adjacent to an open field that is visible, along with the school buildings, in a historical aerial photograph from 1962. There is no evidence of industrial or commercial activity at the area. These locations are likely characteristic of native soils that have been minimally impacted (with respect to potential chemical hazards) by human activity. However, as the area is a maintained grassy field, there is the potential that some pesticides and/or herbicides have been used as part of typical grounds maintenance activities. | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-05 (S12-SCHOOL-11-5)[1] | | Cibao Formation | Oxisol | Metals, Pesticides, Herbicides |
| SS-SCHOOL-07-06 | | Cibao Formation | Oxisol | |
| SS-SCHOOL-07-07 (S12-SCHOOL-11-7)[1] | These locations are adjacent to school buildings. These areas would have been disturbed during construction of the schools, but no industrial or commercial activity has been conducted in these areas. As the areas are adjacent to the school buildings and regularly maintained, there is the potential that some pesticides and/or herbicides have been used as part of typical grounds maintenance activities. | Cibao Formation | Oxisol | Metals, Pesticides, Herbicides |
| SS-SCHOOL-07-08 | | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-09 | | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-10 | | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-11 | | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-12 | | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-13 | | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-14 (S12-SCHOOL-11-4)[1] | This location is on a hillside between the teacher's parking lot and the school buildings; it is visible as an open area in a historical aerial photograph from 1962. There is no evidence of industrial or commercial activity at the area. This location is likely characteristic of native soils that have been minimally impacted (with respect to potential chemical hazards) by human activity. However, as the area is maintained as an open field, there is the potential that some pesticides and/or herbicides have been used as part of typical grounds maintenance activities. | Cibao Formation | Oxisol | Metals, Pesticides, Herbicides |
| SS-SCHOOL-07-15 | When these locations were originally selected they were within a residential development for which construction appears to have just started in a 1962 aerial photograph. Based on this land use there was the potential that some pesticides and/or | Cibao Formation | Oxisol | Metals |

Table 1
Selection of Background Sample Locations

| Background Location | Location Description | Geology | Soil Type (Order) | Analysis Groups |
|---|---|---|---|---|
| SS-SCHOOL-07-16 | herbicides might have been used as part of typical grounds maintenance activities. Since the collection of the 2007 background samples, the development has been raized. | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-17 (S12-SCHOOL-11-8)[1] | The areas where these locations are placed have been open/free of canopy since the early 1960s. Their use specifically as playing fields is apparent in an aerial photograph from 1991, which is also the photograph in which a large school building appears and is adjacent to these fields. There is no evidence to suggest that industrial or commercial activity ocurred at these area. However, based on the fact that the areas remained relatively clear for over 30 years and are currently playing fields, there is the potential that some pesticides and/or herbicides have been used as part of grounds maintenance activities. | Mucarabones Sand | Oxisol | Metals, Pesticides, Herbicides |
| SS-SCHOOL-07-18 | | Mucarabones Sand | Alfisols | Metals |
| SS-SCHOOL-07-19 | | Mucarabones Sand or Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-20 | | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-21 (S12-SCHOOL-11-6)[1] | Currently wooded areas. Based on aerial photographs from 1961-2002 no activities ocurred in these areas. The areas appear open and free of canopy in the 1961 photograph. Revegetation of the areas by trees is apparent in subsequent photographs. These locations are likely characteristic of native soils that have been minimally impacted by human activity. Locations 26 and 27 are in designated protected natural areas. | Mucarabones Sand | Oxisol | Metals, Pesticides, Herbicides |
| SS-SCHOOL-07-22 | | Cibao Formation | Oxisol | Metals |
| SS-SCHOOL-07-23 | | Landslide Deposit | Mollisol | Metals |
| SS-SCHOOL-07-24 | | Cibao Formation | Mollisol | Metals |
| SS-SCHOOL-07-25 | | Cibao Formation | Ultisol | Metals |
| SS-SCHOOL-07-26 (S12-SCHOOL-11-12)[1] | | Mucarabones Sand | Ultisol | Metals, Pesticides, Herbicides |
| SS-SCHOOL-07-27 | | Mucarabones Sand | Mollisol | Metals |
| SS-SCHOOL-07-28 (S12-SCHOOL-11-11)[1] | These locations are on the edge of wooded areas. Based on aerial photographs from 1961-2002 no activities ocurred in these areas. These locations are likely characteristic of native soils that have been minimally impacted by human activity. | Alluvium | Alfisols | Metals, Pesticides, Herbicides |
| SS-SCHOOL-07-29 (S12-SCHOOL-11-10)[1] | | Alluvium | Ultisol | Metals, Pesticides, Herbicides |
| SS-SCHOOL-07-30 (S12-SCHOOL-11-3)[1] | This is currently a wooded area that is designated as a protected natural area. Based on aerial photographs from 1961-2002 no activities ocurred in this area. This location is on the opposite side of a drainage ditch from Site 1 SWMU 1, so it would not have been impacted by activities at that site. | Alluvium | Alfisols | Metals, Pesticides, Herbicides |
| S12-SCHOOL-11-2 | This location is in the vicinity (approximately 12 meters) of a building and parking lot that were constrcuted some time between 1981 and 1991. This location is within a lawn-type area with some mature trees. Based on aerial photographs from 1961-2002 no activities ocurred at this location. As the area is maintained and is in the vicinity of a dwelling, there is the potential that some pesticides and/or herbicides have been used as part of typical grounds maintenance activities. | Alluvium | Oxisol | Pesticides, Herbicides |

Table 1
Selection of Background Sample Locations

| Background Location | Location Description | Geology | Soil Type (Order) | Analysis Groups |
|---|---|---|---|---|
| S12-SCHOOL-11-1 | This location is at the edge of a treeline in the vicinity of the Building 500 warehouse area. The warehouses were constrcuted prior to 1961. There is the potential that some pesticides and/or herbicides have been used in this area as part of typical grounds maintenance activities. | Alluvium | Alfisols | Pesticides, Herbicides |
| S12-SCHOOL-11-9 | This location is at the treeline on the south side of Cemex lake, which has been present since before 1961. Based on aerial photographs from 1961-2002 no activities ocurred at this location. | Alluvium | Alfisols | Pesticides, Herbicides |

1 Samples were assigned different names when collected for pesticides/herbicides analysis. Name presented in parentheses is the name used during the pesticides/herbicides investigation.

Table 2
Outlier Decision Summary - Metals

| Analyte | N | Frequency of Detection | Distribution | Maximum Detected Concentration | No. of Suspected Outliers from Quantile Plot | Suspected Outlier Value | Outlier Evaluation with Rosner Test at 99% Significance Level |
|---|---|---|---|---|---|---|---|
| ALUMINUM | 30 | 30/30 | Normal | 34000 | 1 | 34000 | No potential statistical outlier identified. |
| ANTIMONY | 30 | 1/30 | Insufficient detects. | 2.2 | 1 | 2.2 | NA [1] |
| ARSENIC | 30 | 30/30 | Normal | 47.1 | 1 | 47.1 | No potential statistical outlier identified. |
| BARIUM | 30 | 30/30 | Normal | 118 | 1 | 118 | No potential statistical outlier identified. |
| BERYLLIUM | 30 | 30/30 | Lognormal | 0.77 | 0 | NA | No outliers suspected based on quantile plot evaluation; Rosner test not run. |
| CADMIUM | 30 | 25/30 | Normal | 3.05 | 1 | 3.05 | Potential statistical outlier identified. |
| CALCIUM | 30 | 30/30 | Lognormal | 117000 | 0 | NA | No outliers suspected based on quantile plot evaluation; Rosner test not run. |
| CHROMIUM | 30 | 30/30 | Normal | 89.7 | 2 | 78, 89.7 | No potential statistical outlier identified. |
| COBALT | 30 | 30/30 | Normal | 28 | 1 | 28 | Potential statistical outlier identified. |
| COPPER | 30 | 30/30 | Lognormal | 111 | 0 | NA | No outliers suspected based on quantile plot evaluation; Rosner test not run. |
| IRON | 30 | 30/30 | Normal | 54300 | 1 | 54300 | No potential statistical outlier identified. |
| LEAD | 30 | 30/30 | Normal | 152 | 3 | 152, 103, 82.5 | Three potential statistical outliers identified. |
| MAGNESIUM | 30 | 30/30 | Normal | 8920 | 1 | 8920 | Potential statistical outlier identified. |
| MANGANESE | 30 | 30/30 | Normal | 1280 | 0 | NA | No outliers suspected based on quantile plot evaluation; Rosner test not run. |
| MERCURY | 30 | 30/30 | Lognormal | 1.1 | 1 | 1.1 | Potential statistical outlier identified. |
| NICKEL | 30 | 30/30 | Normal | 42.3 | 2 | 42.3, 29.9 | Two potential statistical outliers identified. |
| POTASSIUM | 30 | 30/30 | Normal | 1710 | 0 | NA | No outliers suspected based on quantile plot evaluation; Rosner test not run. |
| SELENIUM | 30 | 1/30 | Insufficient detects. | 1 | 0 | NA | No outliers suspected based on quantile plot evaluation; Rosner test not run. |
| SILVER | 30 | 3/30 | Insufficient detects. | 2 | 1 | 2 | NA [1] |
| SODIUM | 30 | 20/30 | Lognormal | 271 | 0 | NA | No outliers suspected based on quantile plot evaluation; Rosner test not run. |
| THALLIUM | 30 | 2/30 | Insufficient detects. | 1.1 | 0 | NA | No outliers suspected based on quantile plot evaluation; Rosner test not run. |
| VANADIUM | 30 | 30/30 | Normal | 176 | 1 | 176 | No potential statistical outlier identified. |
| ZINC | 30 | 30/30 | Normal | 603 | 3 | 603, 277, 217 | Three potential statistical outliers identified. |

[1] Rosner test could not be conducted due to insufficient detected data. Therefore, results from the quantile plots were used to identify outliers.

**Table 3**
**Background Comparison Values for Metals in Soils of Fort Buchanan**

| Analyte | Frequency of Detection | Chemical Concentration (mg/kg) | | Outliers Identified | 95% UPL including outliers (mg/kg) | 95% UPL without outliers (mg/kg) | Recommended background comparison value[1] (mg/kg) | EPA Industrial Human Health RSLs[2] (mg/kg) | Region 4 Ecological Soil Screening Value (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|
| | | Maximum | Average | | | | | | |
| ALUMINUM | 30/30 | 34000 | 23063 | 0/30 | 30027 | 30027 | 30027 | 99000* | 50 |
| ANTIMONY | 1/30 | 2.2 | 0.939 | 1/30 | 1.54 | NA | 1 | 41* | 3.5 |
| ARSENIC | 30/30 | 47.1 | 16.33 | 0/30 | 43.87 | 43.87 | 43.9 | 1.6 | 10 |
| BARIUM | 30/30 | 118 | 61.76 | 0/30 | 101.8 | 101.8 | 102 | 19000* | 165 |
| BERYLLIUM | 30/30 | 0.77 | 0.368 | 0/30 | 0.647 | 0.647 | 0.647 | 200* | 1.1 |
| CADMIUM | 25/30 | 3.05 | 0.614 | 1/30 | 1.438 | 0.858 | 0.858 | 80* | 1.6 |
| CALCIUM | 30/30 | 117000 | 27905 | 0/30 | 105848 | 105848 | 105848 | NSA | NSA |
| CHROMIUM | 30/30 | 89.7 | 43.83 | 0/30 | 69.8 | 69.8 | 69.8 | 5.6 | 0.4 |
| COBALT | 30/30 | 28 | 11.09 | 1/30 | 21.18 | 16.57 | 16.57 | 30* | 20 |
| COPPER | 30/30 | 111 | 43 | 0/30 | 83.65 | 83.65 | 83.7 | 4100* | 40 |
| IRON | 30/30 | 54300 | 30169 | 0/30 | 47064 | 47064 | 47064 | 72000* | 200 |
| LEAD | 30/30 | 152 | 27.49 | 3/30 | 125.1 | 27.52 | 27.5 | 800 | 50 |
| MAGNESIUM | 30/30 | 8920 | 2997 | 1/30 | 6876 | 5131 | 5131 | NSA | NSA |
| MANGANESE | 30/30 | 1280 | 706.5 | 0/30 | 1184 | 1184 | 1184 | 2300* | 100 |
| MERCURY | 30/30 | 1.1 | 0.184 | 1/30 | 0.682 | 0.32 | 0.32 | 10* | NSA |
| NICKEL | 30/30 | 42.3 | 14.28 | 2/30 | 26.52 | 23.01 | 23.0 | 2000* | 30 |
| POTASSIUM | 30/30 | 1710 | 847.8 | 0/30 | 1459 | 1459 | 1459 | NSA | NSA |
| SELENIUM | 1/30 | 1 | 0.933 | 0/30 | 1.051 | NA | 1 | 510* | 0.81 |
| SILVER | 3/30 | 2 | 0.81 | 1/30 | 0.825 | NA | 0.22 | 510* | 2 |
| SODIUM | 20/30 | 271 | 165.2 | 0/30 | 237.5 | 237.5 | 238 | NSA | NSA |
| THALLIUM | 2/30 | 1.1 | 1.01 | 0/30 | 0.982 | NA | 1.1 | 1* | 1 |
| VANADIUM | 30/30 | 176 | 96.13 | 0/30 | 145.4 | 145.4 | 145 | 520* | 2 |
| ZINC | 30/30 | 603 | 84.23 | 3/30 | 423.7 | 81.04 | 81.0 | 31000* | 50 |

1) For the recommended background comparison value, priority was given as follows;

- If 95UPL could be calculated and there were **no outliers**, then recommended background value is the 95% UPL.
- If 95UPL could be calculated and there **were outliers**, then the recommended background value is the 95% UPL without outliers
- If 95UPL could **not be calculated**, and there were **no outliers**, then the recommended background value is maximum detected concentration
- If 95UPL could **not be calculated**, and there **were outliers**, then the recommended background value is maximum detected concentration that is not an outlier
- Antimony was detected in only one sample and the concentration was identified as an outlier. Therefore, the recommended background value is the maximum detection limit

2) United States Environmental Protection Agency Regional Screening Levels, June 2011.

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

Table 4

Outlier Decision Summary - Pesticides

| Analyte | N | Frequency of Detection | Distribution | Maximum Detected Concentration | No. of Suspected Outliers from Quantile Plot | Suspected Outlier Value | Outlier Evaluation with Rosner or Dixon Test at 99% Significance Level |
|---|---|---|---|---|---|---|---|
| 4,4-DDD | 12 | 1/12 | Insufficient detects. | 0.502 | 1 | 0.502 | NA [1] |
| 4,4-DDE | 12 | 6/12 | Normal | 0.65 | 1 | 0.65 | Potential statistical outlier identified. |
| 4,4-DDT | 12 | 6/12 | Normal | 0.198 | 1 | 0.198 | Potential statistical outlier identified. |
| ALPHA-CHLORDANE | 12 | 1/12 | Insufficient detects. | 0.009 | 1 | 0.009 | NA [1] |
| ENDOSULFAN II | 12 | 1/12 | Insufficient detects. | 0.0082 | 1 | 0.0082 | NA [1] |
| ENDOSULFAN SULFATE | 12 | 1/12 | Insufficient detects. | 0.0022 | 1 | 0.0022 | NA [1] |
| TRANS-CHLORDANE | 12 | 1/12 | Insufficient detects. | 0.0085 | 1 | 0.0085 | NA [1] |

[1] Rosner or Dixon test could not be conducted due to insufficient detected data. Therefore, results from the quantile plots were used to identify outliers.

Table 5
Background Comparison Values for Pesticides in Fort Buchanan Soils

| Analyte | Frequency of Detection | Chemical Concentration (mg/kg) | | Outliers Identified | 95% UPL (mg/kg) | Recommended background comparison value[1] (mg/kg) | EPA Industrial Human Health RSLs[2] (mg/kg) | Region 4 Ecological Soil Screening Value (mg/kg) |
|---|---|---|---|---|---|---|---|---|
| | | Maximum | Average | | | | | |
| 4,4-DDD | 1/12 | 0.502 | 0.0422 | 1/12 | NA | 0.00051 | 7.2 | NSV |
| 4,4-DDE | 6/12 | 0.65 | 0.0556 | 1/12 | 0.00337 | 0.00337 | 5.1 | NSV |
| 4,4-DDT | 6/12 | 0.198 | 0.0177 | 1/12 | 0.00265 | 0.00265 | 7 | NSV |
| ALPHA-CHLORDANE | 1/12 | 0.009 | 0.00123 | 1/12 | NA | 0.00064 | 6.5 | NSV |
| ENDOSULFAN II | 1/12 | 0.0082 | 0.00118 | 1/12 | NA | 0.00065 | 370 | NSV |
| ENDOSULFAN SULFATE | 1/12 | 0.0022 | 0.00086 | 1/12 | NA | 0.0009 | 370 | NSV |
| TRANS-CHLORDANE | 1/12 | 0.0085 | 0.00109 | 1/12 | NA | 0.00051 | 6.5 | NSV |

1) For DDE and DDT the recommended background comparison value was the 95% UPL with outliers removed. For all other pesticides, whose only detected concentrations were identified as outliers, the maximum reporting limit was identified as the recommended background comparison value.

2) United States Environmental Protection Agency Regional Screening Levels, June 2011.

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1

NA = Not applicable.

NSV = No screening value.

# Attachment 1

Raw Data and ProUCL Summary Statistics - Metals

Fort Buchanan Background Metals Data for Soil

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample Name:** | SS-SCHOOL-07-01 | SS-SCHOOL-07-02 | SS-SCHOOL-07-03 | 07-JL-10-DP1 | SS-SCHOOL-07-04 | SS-SCHOOL-07-05 | SS-SCHOOL-07-06 |
| | | | | **Parent Sample Name:** | | | | SS-SCHOOL-07-03 | | | |
| | | | | **Sample Date:** | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 |
| **Analyte** | **Min** | **Max** | **No. Detects** | **Units** | | | | | | | |
| Aluminum | 14700 | 34000 | 33 | mg/kg | 14700 | 23000 | 16500 | 16500 | 23600 | 34000 | 20600 |
| Antimony | 2.2 | 2.2 | 1 | mg/kg | 0.85 U | 0.92 U | 0.83 U | 0.81 U | 0.86 U | 0.86 U | 0.84 U |
| Arsenic | 3 | 47.1 | 33 | mg/kg | 3.7 | 8.9 | 12.7 | 15.2 | 12.6 | 15.8 | 8.6 |
| Barium | 25.8 | 118 | 33 | mg/kg | 59.3 | 46 | 40.2 | 42.7 | 70.9 | 99.1 | 39.1 |
| Beryllium | 0.029 | 0.77 | 33 | mg/kg | 0.19 B | 0.19 B | 0.22 B | 0.19 B | 0.34 B | 0.48 B | 0.25 B |
| Cadmium | 0.19 | 3.3 | 28 | mg/kg | 0.71 | 0.52 B | 2.8 | 3.3 | 0.9 | 0.42 B | 0.58 |
| Calcium | 3110 | 117000 | 33 | mg/kg | 3600 | 22000 | 36700 | 37200 | 52600 | 11900 | 94800 |
| Chromium | 17.5 | 89.7 | 33 | mg/kg | 17.5 | 25.9 | 31.9 | 34.4 | 51.5 | 89.7 | 29.8 |
| Cobalt | 4 | 28 | 33 | mg/kg | 8 | 6.8 | 6.7 | 7.2 | 14.6 | 28 | 11.8 |
| Copper | 14.9 | 111 | 33 | mg/kg | 28.6 | 25.1 | 30 | 32.9 | 51.6 | 88 | 50.2 |
| Iron | 8350 | 54300 | 33 | mg/kg | 20800 | 25600 | 23600 | 23200 | 34100 | 54300 | 26100 |
| Lead | 8.1 | 152 | 33 | mg/kg | 21.3 | 27.7 | 79.5 | 85.2 | 23.4 | 14.9 | 15.8 |
| Magnesium | 625 | 8920 | 33 | mg/kg | 1900 | 2460 | 1940 | 1910 | 5330 | 8920 | 5490 |
| Manganese | 232 | 1280 | 33 | mg/kg | 392 | 308 | 378 | 441 | 754 | 1280 | 678 |
| Mercury | 0.057 | 1.1 | 33 | mg/kg | 0.081 | 0.13 | 0.28 | 0.29 | 0.1 | 0.1 | 0.066 |
| Nickel | 6.3 | 42.3 | 33 | mg/kg | 6.3 | 8 | 9.5 | 9.5 | 21.8 | 42.3 | 13.2 |
| Potassium | 276 | 1710 | 33 | mg/kg | 694 B | 782 B | 578 B | 733 B | 813 B | 797 B | 620 B |
| Selenium | 1 | 1 | 1 | mg/kg | 0.89 U | 0.96 U | 0.87 U | 0.85 U | 0.9 U | 0.89 U | 0.87 U |
| Silver | 0.21 | 2 | 3 | mg/kg | 0.18 U | 0.19 U | 0.17 U | 0.21 B | 0.18 U | 0.18 U | 0.17 U |
| Sodium | 98.1 | 349 | 21 | mg/kg | 98.1 B | 121 B | 134 B | 85 U | 256 B | 265 B | 349 B |
| Thallium | 0.92 | 1.1 | 2 | mg/kg | 0.95 U | 1 U | 0.92 U | 0.9 U | 0.96 U | 0.95 U | 0.93 U |
| Vanadium | 46.2 | 176 | 33 | mg/kg | 70.5 | 76.9 | 73.6 | 79.1 | 108 | 176 | 86 |
| Zinc | 27.6 | 603 | 33 | mg/kg | 35.7 | 53.5 | 56.3 | 49.7 | 61.7 | 86.3 | 56.2 |
| **Geology/Soil Type** | | | | | | | | | | | |
| Geology | -- | -- | -- | -- | Cibao Formation | Cibao Formation | Cibao Formation | Cibao Formation | Cibao Formation | Cibao Formation | Cibao Formation |
| Soil Order | -- | -- | -- | -- | Oxisol | Oxisol | Oxisol | Oxisol | Oxisol | Oxisol | Oxisol |

Min = Minimum detected concentration

Max = Maximum detected concentration

No. Detects = Number of positive detections out of the 33 samples, including field duplicates

B = Analyte was found in an associated blank sample

J = Estimated value

U = Not detected, value presented in the detection limit

Fort Buchanan Background Metals Data for Soil

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample Name:** | 07-JL-10-DP2 | SS-SCHOOL-07-07 | SS-SCHOOL-07-08 | SS-SCHOOL-07-09 | SS-SCHOOL-07-10 | SS-SCHOOL-07-11 | SS-SCHOOL-07-12 |
| | | | | **Parent Sample Name:** | SS-SCHOOL-07-06 | | | | | | |
| | | | | **Sample Date:** | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 |
| **Analyte** | **Min** | **Max** | **No. Detects** | **Units** | | | | | | | |
| Aluminum | 14700 | 34000 | 33 | mg/kg | 21900 | 26300 | 20600 | 24100 | 21400 | 26000 | 28700 |
| Antimony | 2.2 | 2.2 | 1 | mg/kg | 0.82 U | 0.91 U | 0.86 U | 0.85 U | 1 U | 0.94 U | 0.98 U |
| Arsenic | 3 | 47.1 | 33 | mg/kg | 9.7 | 5.9 | 4.7 | 4.8 | 4.5 | 28.2 | 33.5 |
| Barium | 25.8 | 118 | 33 | mg/kg | 38.1 | 30.4 | 28 | 72.8 | 25.8 B | 36.3 | 77.5 |
| Beryllium | 0.029 | 0.77 | 33 | mg/kg | 0.029 B | 0.23 B | 0.19 B | 0.33 B | 0.16 B | 0.52 B | 0.5 B |
| Cadmium | 0.19 | 3.3 | 28 | mg/kg | 0.83 | 0.18 U | 0.17 U | 0.19 B | 0.2 U | 0.31 B | 0.3 B |
| Calcium | 3110 | 117000 | 33 | mg/kg | 54900 | 6620 | 33600 | 17700 | 5430 | 63200 | 41400 |
| Chromium | 17.5 | 89.7 | 33 | mg/kg | 27.3 | 60.4 | 42 | 46.2 | 47.6 | 58.5 | 52.7 |
| Cobalt | 4 | 28 | 33 | mg/kg | 17.7 | 5.1 B | 4 B | 14.1 | 5.6 B | 10 | 13.3 |
| Copper | 14.9 | 111 | 33 | mg/kg | 80.2 | 20.9 | 21.6 | 42.6 | 14.9 | 39.6 | 61.4 |
| Iron | 8350 | 54300 | 33 | mg/kg | 27300 | 11300 | 9720 | 27000 | 8350 | 35900 | 43000 |
| Lead | 8.1 | 152 | 33 | mg/kg | 21.9 | 17.8 | 29.8 | 12.1 | 22.6 | 8.1 | 16.2 |
| Magnesium | 625 | 8920 | 33 | mg/kg | 6680 | 914 | 1670 | 4640 | 625 B | 2520 | 4310 |
| Manganese | 232 | 1280 | 33 | mg/kg | 797 | 471 | 252 | 594 | 417 | 516 | 782 |
| Mercury | 0.057 | 1.1 | 33 | mg/kg | 0.057 | 0.089 | 0.083 | 0.084 | 0.14 | 0.11 | 0.078 |
| Nickel | 6.3 | 42.3 | 33 | mg/kg | 12.5 | 11.3 | 11.1 | 20.9 | 10.7 | 14.1 | 18.5 |
| Potassium | 276 | 1710 | 33 | mg/kg | 785 B | 337 B | 438 B | 758 B | 276 B | 757 B | 1220 B |
| Selenium | 1 | 1 | 1 | mg/kg | 0.85 U | 0.95 U | 0.89 U | 0.89 U | 1.1 U | 0.98 U | 1 U |
| Silver | 0.21 | 2 | 3 | mg/kg | 0.17 U | 0.19 U | 0.18 U | 0.18 U | 0.21 U | 0.2 U | 0.2 U |
| Sodium | 98.1 | 349 | 21 | mg/kg | 108 B | 114 B | 172 B | 146 B | 170 B | 221 B | 197 B |
| Thallium | 0.92 | 1.1 | 2 | mg/kg | 0.91 U | 1 U | 0.95 U | 0.94 U | 1.1 U | 1 U | 1.1 U |
| Vanadium | 46.2 | 176 | 33 | mg/kg | 98.8 | 60.8 | 46.2 | 93.2 | 47.4 | 90.3 | 127 |
| Zinc | 27.6 | 603 | 33 | mg/kg | 46.8 | 27.6 | 29.8 | 48.5 | 29.3 | 55.8 | 71.1 |
| **Geology/Soil Type** | | | | | | | | | | | |
| Geology | -- | -- | -- | -- | Cibao Formation | Cibao Formation | Cibao Formation | Cibao Formation | Cibao Formation | Cibao Formation | Cibao Formation |
| Soil Order | -- | -- | -- | -- | Oxisol | Oxisol | Oxisol | Oxisol | Oxisol | Oxisol | Oxisol |

Min = Minimum detected concentration

Max = Maximum detected concentration

No. Detects = Number of positive detections out of the 33 sampl

B = Analyte was found in an associated blank sample

J = Estimated value

U = Not detected, value presented in the detection limit

Fort Buchanan Background Metals Data for Soil

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample Name:** | SS-SCHOOL-07-13 | SS-SCHOOL-07-14 | SS-SCHOOL-07-15 | SS-SCHOOL-07-16 | SS-SCHOOL-07-17 | SS-SCHOOL-07-18 | SS-SCHOOL-07-19 |
| | | | | **Parent Sample Name:** | | | | | | | |
| | | | | **Sample Date:** | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 |
| **Analyte** | **Min** | **Max** | **No. Detects** | **Units** | | | | | | | |
| Aluminum | 14700 | 34000 | 33 | mg/kg | 26300 | 24200 | 22500 | 23500 | 21000 | 22200 | 22100 |
| Antimony | 2.2 | 2.2 | 1 | mg/kg | 0.95 U | 0.93 U | 1 U | 0.92 U | 0.9 U | 0.76 U | 0.75 U |
| Arsenic | 3 | 47.1 | 33 | mg/kg | 11.7 | 15.2 | 14.3 | 18 | 19.1 | 15.9 | 19.7 |
| Barium | 25.8 | 118 | 33 | mg/kg | 118 | 70.5 | 42.2 | 78.1 | 78 | 79.4 | 62.7 |
| Beryllium | 0.029 | 0.77 | 33 | mg/kg | 0.53 B | 0.45 B | 0.24 B | 0.26 B | 0.31 B | 0.3 B | 0.27 B |
| Cadmium | 0.19 | 3.3 | 28 | mg/kg | 0.3 B | 0.32 B | 0.19 U | 0.18 U | 0.26 B | 0.29 B | 0.24 B |
| Calcium | 3110 | 117000 | 33 | mg/kg | 32100 | 72800 | 4570 | 6190 | 20100 | 9630 | 9730 |
| Chromium | 17.5 | 89.7 | 33 | mg/kg | 36.9 | 36.3 | 27.9 | 36.3 | 42.6 | 41.8 | 50 |
| Cobalt | 4 | 28 | 33 | mg/kg | 15.8 | 11.1 | 5.1 B | 6.8 | 13.2 | 12.1 | 10.3 |
| Copper | 14.9 | 111 | 33 | mg/kg | 79.6 | 36.2 | 22.1 | 25.8 | 40.1 | 43.6 | 38.8 |
| Iron | 8350 | 54300 | 33 | mg/kg | 34100 | 27400 | 26000 | 29800 | 36500 | 33300 | 35300 |
| Lead | 8.1 | 152 | 33 | mg/kg | 16.5 | 13 | 15.5 | 13.2 | 20.5 | 25.7 | 19.9 |
| Magnesium | 625 | 8920 | 33 | mg/kg | 4420 | 3060 | 1590 | 1630 | 2380 | 2650 | 2580 |
| Manganese | 232 | 1280 | 33 | mg/kg | 875 | 752 | 232 | 514 | 1210 | 936 | 702 |
| Mercury | 0.057 | 1.1 | 33 | mg/kg | 0.17 | 0.089 | 0.09 | 0.12 | 0.14 | 0.12 | 0.097 |
| Nickel | 6.3 | 42.3 | 33 | mg/kg | 17.8 | 11.1 | 7.4 | 7.6 | 12.1 | 13.6 | 13.4 |
| Potassium | 276 | 1710 | 33 | mg/kg | 1110 B | 1040 B | 503 B | 483 B | 448 B | 761 B | 741 B |
| Selenium | 1 | 1 | 1 | mg/kg | 0.99 U | 0.97 U | 1 U | 0.96 U | 0.93 U | 0.79 U | 0.78 U |
| Silver | 0.21 | 2 | 3 | mg/kg | 0.2 U | 0.19 U | 0.21 U | 0.19 U | 0.19 U | 0.16 U | 0.16 U |
| Sodium | 98.1 | 349 | 21 | mg/kg | 116 B | 152 B | 112 B | 97 U | 117 B | 170 B | 106 B |
| Thallium | 0.92 | 1.1 | 2 | mg/kg | 1.1 U | 1 U | 1.1 U | 1 U | 1 U | 0.85 U | 0.83 U |
| Vanadium | 46.2 | 176 | 33 | mg/kg | 103 | 77.8 | 84.2 | 91.1 | 105 | 101 | 106 |
| Zinc | 27.6 | 603 | 33 | mg/kg | 91.1 | 54.1 | 42.3 | 37.3 | 64.7 | 70.3 | 72.5 |
| **Geology/Soil Type** | | | | | | | | | | | |
| Geology | -- | -- | -- | -- | Cibao Formation | Cibao Formation | Cibao Formation | Cibao Formation | Mucarabones Sand | Mucarabones Sand | Mucarabones Sand or Cibao Formation |
| Soil Order | -- | -- | -- | -- | Oxisol | Oxisol | Oxisol | Oxisol | Oxisol | Alfisols | Oxisol |

Min = Minimum detected concentration

Max = Maximum detected concentration

No. Detects = Number of positive detections out of the 33 sampl

B = Analyte was found in an associated blank sample

J = Estimated value

U = Not detected, value presented in the detection limit

Fort Buchanan Background Metals Data for Soil

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample Name:** | SS-SCHOOL-07-20 | SS-SCHOOL-07-21 | 07-JL-10-DP3 | SS-SCHOOL-07-22 | SS-SCHOOL-07-23 | SS-SCHOOL-07-24 | SS-SCHOOL-07-25 |
| | | | | **Parent Sample Name:** | | | SS-SCHOOL-07-21 | | | | |
| | | | | **Sample Date:** | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 |
| **Analyte** | **Min** | **Max** | **No. Detects** | **Units** | | | | | | | |
| Aluminum | 14700 | 34000 | 33 | mg/kg | 22200 | 22000 | 19300 | 21900 | 21700 | 23600 | 27300 |
| Antimony | 2.2 | 2.2 | 1 | mg/kg | 0.86 U | 0.9 U | 0.92 U | 0.89 U | 0.91 U | 0.91 U | 0.96 U |
| Arsenic | 3 | 47.1 | 33 | mg/kg | 3 | 35.2 | 31.7 | 15.6 | 13.2 | 47.1 | 14.8 |
| Barium | 25.8 | 118 | 33 | mg/kg | 91.6 | 33.6 | 42.6 | 65.5 | 44.8 | 96.3 | 62.6 |
| Beryllium | 0.029 | 0.77 | 33 | mg/kg | 0.55 B | 0.33 B | 0.32 B | 0.41 B | 0.38 B | 0.71 | 0.52 B |
| Cadmium | 0.19 | 3.3 | 28 | mg/kg | 0.26 B | 0.78 | 0.66 | 0.61 B | 0.47 B | 0.86 | 0.58 B |
| Calcium | 3110 | 117000 | 33 | mg/kg | 5910 | 3150 | 3110 | 4560 | 56800 | 4360 | 6890 |
| Chromium | 17.5 | 89.7 | 33 | mg/kg | 28.7 | 54.7 | 54.2 | 34 | 30.6 | 78 | 40.1 |
| Cobalt | 4 | 28 | 33 | mg/kg | 14.7 | 6.4 | 7.9 | 14.2 | 12.2 | 13.9 | 13.3 |
| Copper | 14.9 | 111 | 33 | mg/kg | 58 | 32.3 | 31 | 30.3 | 32.9 | 38.5 | 43.5 |
| Iron | 8350 | 54300 | 33 | mg/kg | 31200 | 44200 | 42000 | 34100 | 25300 | 43200 | 33800 |
| Lead | 8.1 | 152 | 33 | mg/kg | 12.2 | 13.5 | 12.6 | 16.3 | 9 | 21.8 | 18.7 |
| Magnesium | 625 | 8920 | 33 | mg/kg | 4940 | 1230 | 1090 | 1630 | 2950 | 1740 | 2940 |
| Manganese | 232 | 1280 | 33 | mg/kg | 672 | 655 | 1020 | 1110 | 690 | 1030 | 1010 |
| Mercury | 0.057 | 1.1 | 33 | mg/kg | 0.078 | 0.26 | 0.28 | 0.25 | 0.12 | 0.3 | 0.25 |
| Nickel | 6.3 | 42.3 | 33 | mg/kg | 14 | 10.8 | 11.3 | 9.8 | 9.7 | 16.8 | 11.9 |
| Potassium | 276 | 1710 | 33 | mg/kg | 723 B | 740 B | 651 B | 840 B | 1220 B | 632 B | 1170 B |
| Selenium | 1 | 1 | 1 | mg/kg | 0.9 U | 1 B | 0.96 U | 0.92 U | 0.95 U | 0.95 U | 1 U |
| Silver | 0.21 | 2 | 3 | mg/kg | 0.22 B | 0.19 U | 0.19 U | 0.18 U | 0.19 U | 0.19 U | 0.2 U |
| Sodium | 98.1 | 349 | 21 | mg/kg | 271 B | 94 U | 96 U | 93 U | 96 U | 96 U | 100 U |
| Thallium | 0.92 | 1.1 | 2 | mg/kg | 0.96 U | 1 U | 1 U | 0.98 U | 1 U | 1.1 B | 1.1 U |
| Vanadium | 46.2 | 176 | 33 | mg/kg | 93 | 147 | 140 | 109 | 71.4 | 138 | 86.2 |
| Zinc | 27.6 | 603 | 33 | mg/kg | 60.1 | 43.2 | 42.1 | 40.9 | 38.2 | 54.2 | 55.6 |
| **Geology/Soil Type** | | | | | | | | | | | |
| Geology | -- | -- | -- | -- | Cibao Formation | Mucarabones Sand | Mucarabones Sand | Cibao Formation | Landslide Deposit | Cibao Formation | Cibao Formation |
| Soil Order | -- | -- | -- | -- | Oxisol | Oxisol | Oxisol | Oxisol | Mollisol | Mollisol | Ultisol |

Min = Minimum detected concentration

Max = Maximum detected concentration

No. Detects = Number of positive detections out of the 33 sampl

B = Analyte was found in an associated blank sample

J = Estimated value

U = Not detected, value presented in the detection limit

Fort Buchanan Background Metals Data for Soil

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample Name:** | SS-SCHOOL-07-26 | SS-SCHOOL-07-27 | SS-SCHOOL-07-28 | SS-SCHOOL-07-29 | SS-SCHOOL-07-30 |
| | | | | **Parent Sample Name:** | | | | | |
| | | | | **Sample Date:** | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 | 7/10/2007 |
| **Analyte** | **Min** | **Max** | **No. Detects** | **Units** | | | | | |
| Aluminum | 14700 | 34000 | 33 | mg/kg | 27400 | 28000 | 24000 | 16100 | 17100 |
| Antimony | 2.2 | 2.2 | 1 | mg/kg | 0.99 U | 0.95 U | 0.82 U | 0.88 U | 2.2 B |
| Arsenic | 3 | 47.1 | 33 | mg/kg | 10.8 | 16.9 | 21.1 | 26.9 | 27.4 |
| Barium | 25.8 | 118 | 33 | mg/kg | 56.6 | 67.2 | 64.1 | 33.7 | 77.1 |
| Beryllium | 0.029 | 0.77 | 33 | mg/kg | 0.45 B | 0.52 B | 0.23 B | 0.77 | 0.34 B |
| Cadmium | 0.19 | 3.3 | 28 | mg/kg | 0.53 B | 0.64 B | 0.55 B | 0.78 | 0.83 |
| Calcium | 3110 | 117000 | 33 | mg/kg | 9460 | 15200 | 8560 | 80300 | 117000 |
| Chromium | 17.5 | 89.7 | 33 | mg/kg | 37.9 | 43.9 | 41.3 | 44.6 | 55.8 |
| Cobalt | 4 | 28 | 33 | mg/kg | 11.4 | 12.5 | 10.6 | 9.3 | 7.7 |
| Copper | 14.9 | 111 | 33 | mg/kg | 39.9 | 43.4 | 43.6 | 40 | 111 |
| Iron | 8350 | 54300 | 33 | mg/kg | 31000 | 31800 | 34500 | 25500 | 29000 |
| Lead | 8.1 | 152 | 33 | mg/kg | 23.2 | 21.3 | 14.7 | 103 | 152 |
| Magnesium | 625 | 8920 | 33 | mg/kg | 3130 | 2730 | 3540 | 3370 | 2170 |
| Manganese | 232 | 1280 | 33 | mg/kg | 683 | 1030 | 797 | 713 | 489 |
| Mercury | 0.057 | 1.1 | 33 | mg/kg | 0.25 | 0.28 | 0.11 | 0.34 | 1.1 |
| Nickel | 6.3 | 42.3 | 33 | mg/kg | 12.4 | 13.7 | 9.6 | 19.2 | 29.9 |
| Potassium | 276 | 1710 | 33 | mg/kg | 1460 | 1130 B | 1600 | 1710 | 938 B |
| Selenium | 1 | 1 | 1 | mg/kg | 1 U | 0.99 U | 0.85 U | 0.92 U | 0.92 U |
| Silver | 0.21 | 2 | 3 | mg/kg | 0.21 U | 0.2 U | 0.17 U | 0.18 U | 2 |
| Sodium | 98.1 | 349 | 21 | mg/kg | 100 U | 100 U | 137 B | 92 U | 93 U |
| Thallium | 0.92 | 1.1 | 2 | mg/kg | 1.1 U | 1.1 U | 0.92 B | 0.98 U | 0.98 U |
| Vanadium | 46.2 | 176 | 33 | mg/kg | 82.4 | 89.8 | 99.9 | 90.5 | 147 |
| Zinc | 27.6 | 603 | 33 | mg/kg | 46.6 | 55.6 | 277 | 603 | 217 |
| **Geology/Soil Type** | | | | | | | | | |
| Geology | -- | -- | -- | -- | Mucarabones Sand | Mucarabones Sand | Alluvium | Alluvium | Alluvium |
| Soil Order | -- | -- | -- | -- | Ultisol | Mollisol | Alfisols | Ultisol | Alfisols |

Min = Minimum detected concentration

Max = Maximum detected concentration

No. Detects = Number of positive detections out of the 33 sampl

B = Analyte was found in an associated blank sample

J = Estimated value

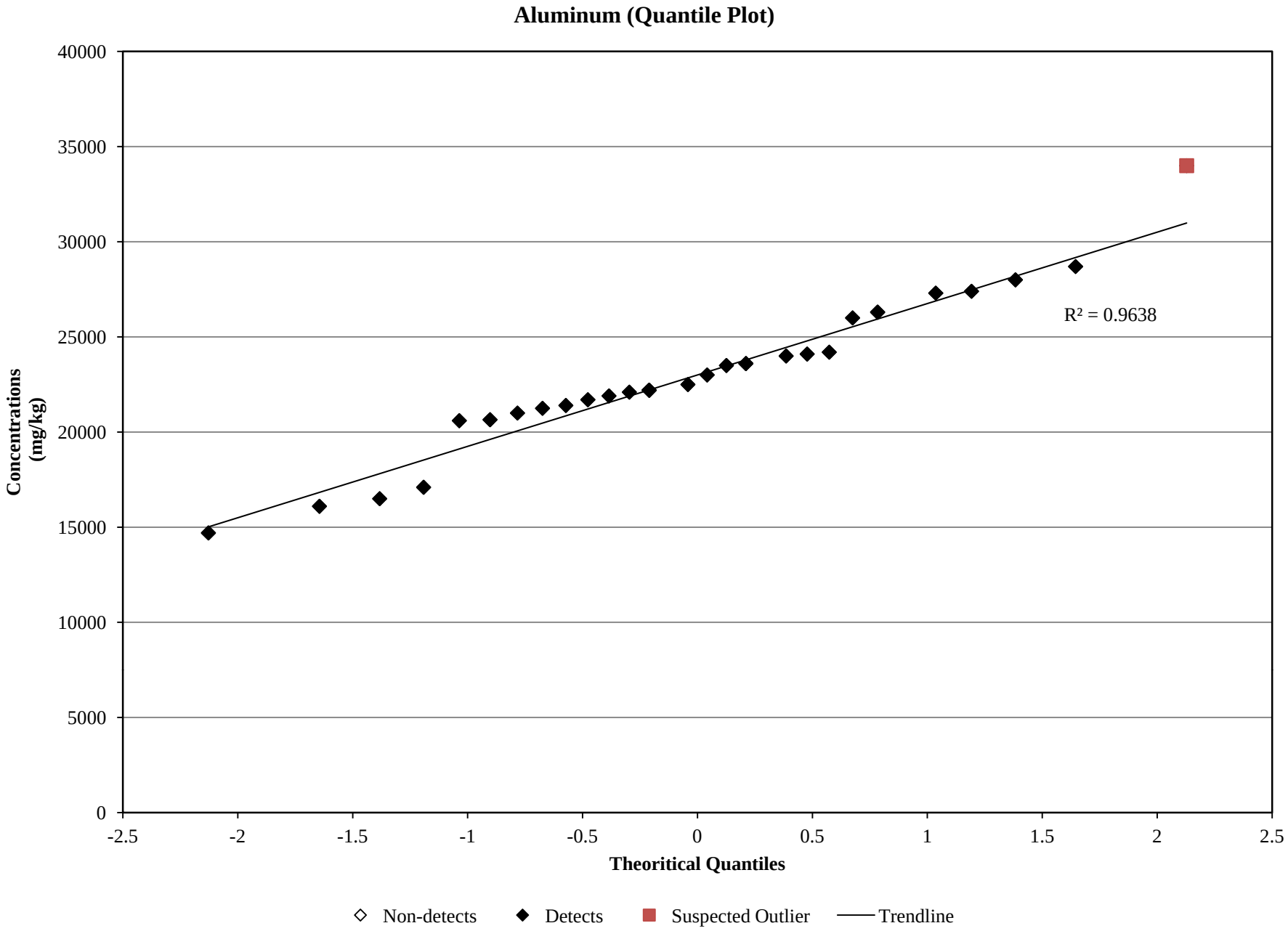
U = Not detected, value presented in the detection limit

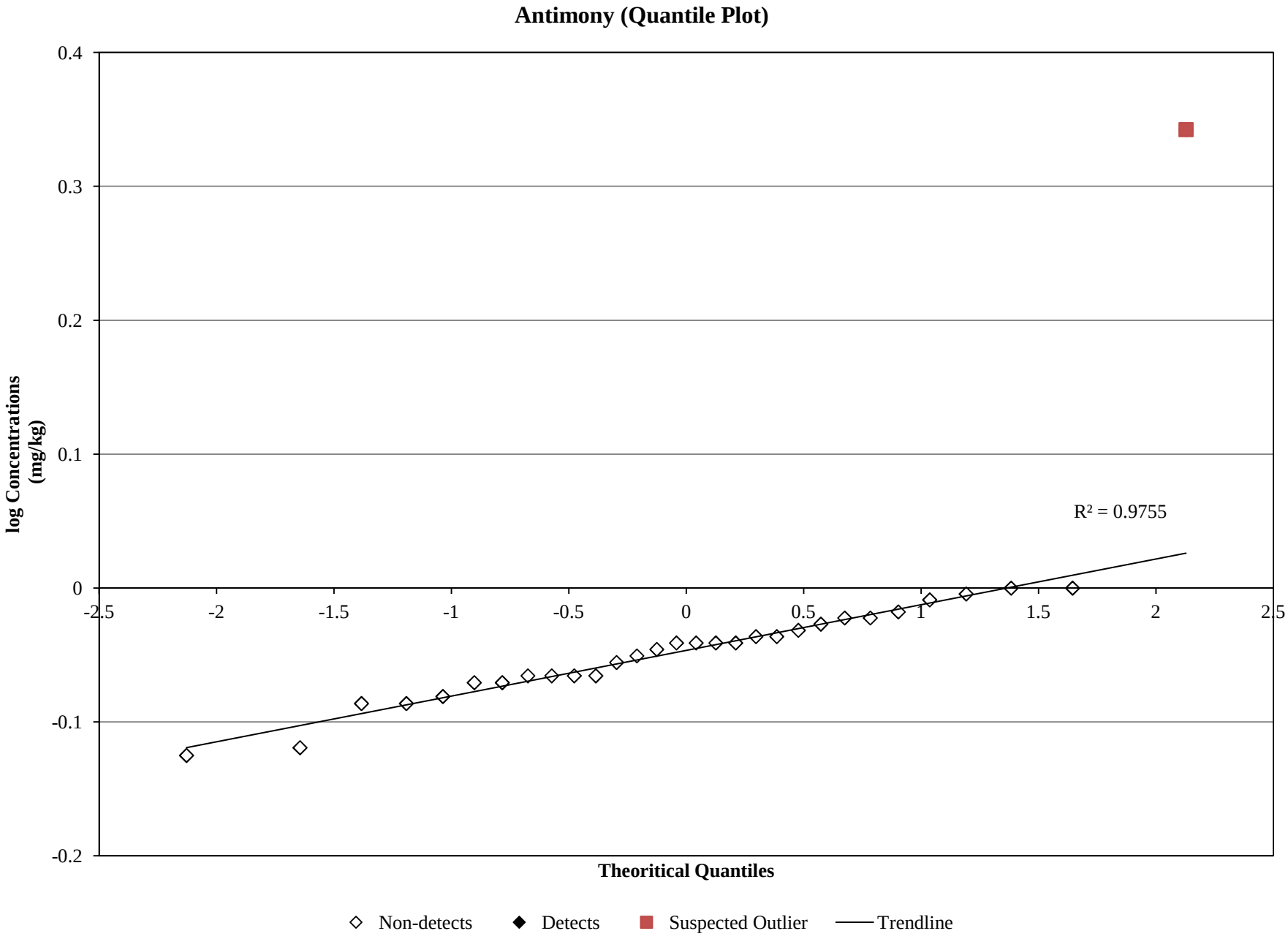
## Summary Statistics for Raw Data Sets with NDs using Detected Data Only

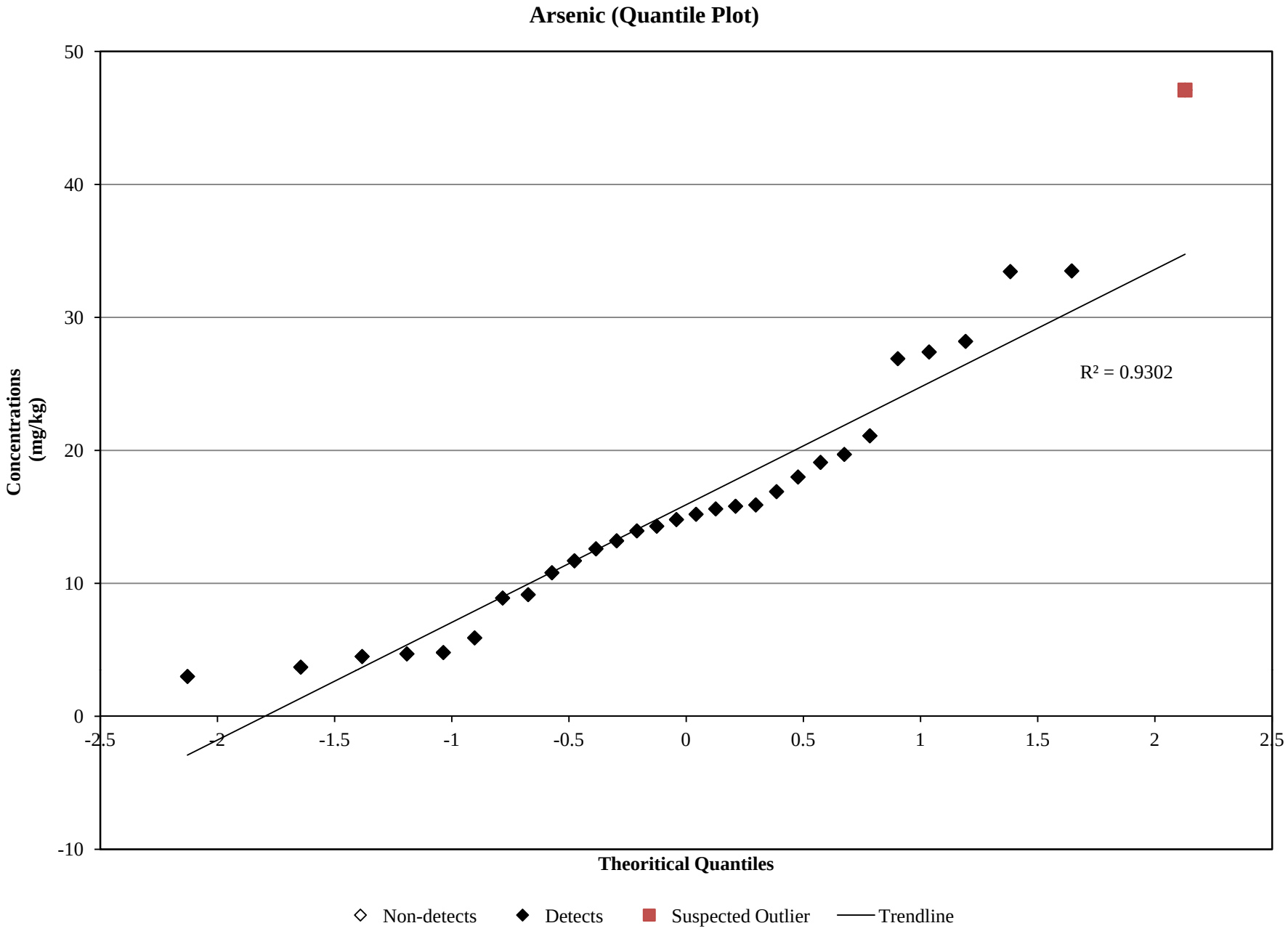
| | | | | Raw Statistics using Detected Observations | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | Num Ds | NumNDs | % NDs | Minimum | Maximum | Mean | Median | SD | CV |
| ALUMINUM | 30 | 0 | 0.00% | 14700 | 34000 | 23063 | 22750 | 4031 | 0.175 |
| ANTIMONY | 1 | 29 | 96.67% | 2.2 | 2.2 | 2.2 | 2.2 | N/A | N/A |
| ARSENIC | 30 | 0 | 0.00% | 3 | 47.1 | 16.33 | 15 | 10.18 | 0.624 |
| BARIUM | 30 | 0 | 0.00% | 25.8 | 118 | 61.76 | 63.4 | 23.2 | 0.376 |
| BERYLLIUM | 30 | 0 | 0.00% | 0.14 | 0.77 | 0.368 | 0.335 | 0.162 | 0.439 |
| CADMIUM | 25 | 5 | 16.67% | 0.19 | 3.05 | 0.614 | 0.53 | 0.552 | 0.899 |
| CALCIUM | 30 | 0 | 0.00% | 3130 | 117000 | 27905 | 13550 | 29424 | 1.054 |
| CHROMIUM | 30 | 0 | 0.00% | 17.5 | 89.7 | 43.83 | 41.9 | 15.04 | 0.343 |
| COBALT | 30 | 0 | 0.00% | 4 | 28 | 11.09 | 11.25 | 4.698 | 0.424 |
| COPPER | 30 | 0 | 0.00% | 14.9 | 111 | 43 | 39.75 | 20.98 | 0.488 |
| IRON | 30 | 0 | 0.00% | 8350 | 54300 | 30169 | 31100 | 9781 | 0.324 |
| LEAD | 30 | 0 | 0.00% | 8.1 | 152 | 27.49 | 18.78 | 30.73 | 1.118 |
| MAGNESIUM | 30 | 0 | 0.00% | 625 | 8920 | 2997 | 2615 | 1736 | 0.579 |
| MANGANESE | 30 | 0 | 0.00% | 232 | 1280 | 706.5 | 707.5 | 276.5 | 0.391 |
| MERCURY | 30 | 0 | 0.00% | 0.0615 | 1.1 | 0.184 | 0.12 | 0.192 | 1.042 |
| NICKEL | 30 | 0 | 0.00% | 6.3 | 42.3 | 14.28 | 12.25 | 7.29 | 0.51 |
| POTASSIUM | 30 | 0 | 0.00% | 276 | 1710 | 847.8 | 759.5 | 354.1 | 0.418 |
| SELENIUM | 1 | 29 | 96.67% | 1 | 1 | 1 | 1 | N/A | N/A |
| SILVER | 3 | 27 | 90.00% | 0.21 | 2 | 0.81 | 0.22 | 1.031 | 1.272 |
| SODIUM | 20 | 10 | 33.33% | 98.1 | 271 | 165.2 | 149 | 56.24 | 0.34 |
| THALLIUM | 2 | 28 | 93.33% | 0.92 | 1.1 | 1.01 | 1.01 | 0.127 | 0.126 |
| VANADIUM | 30 | 0 | 0.00% | 46.2 | 176 | 96.13 | 91.75 | 28.5 | 0.297 |
| ZINC | 30 | 0 | 0.00% | 27.6 | 603 | 84.23 | 54.15 | 111 | 1.317 |

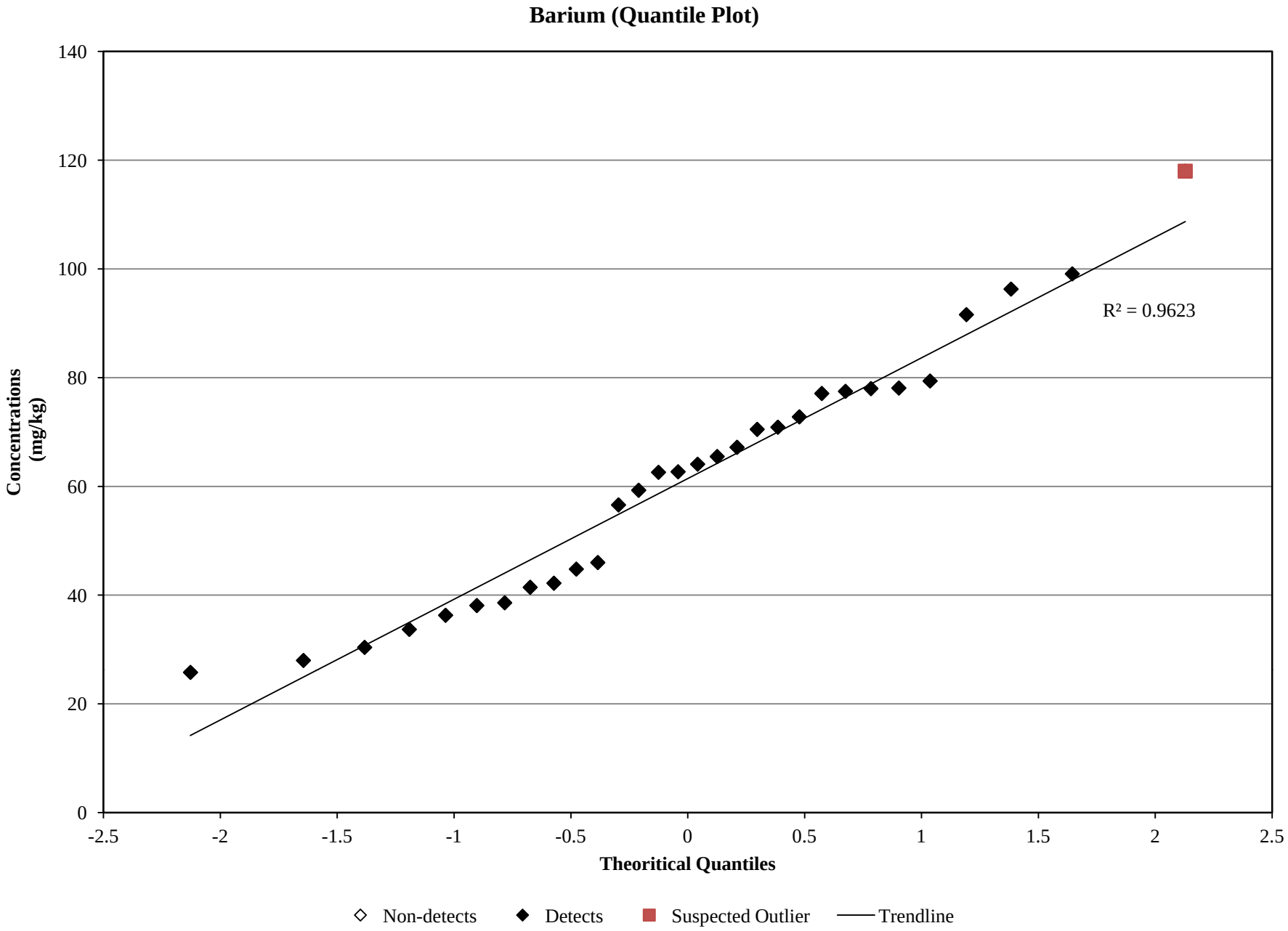
# Attachment 2

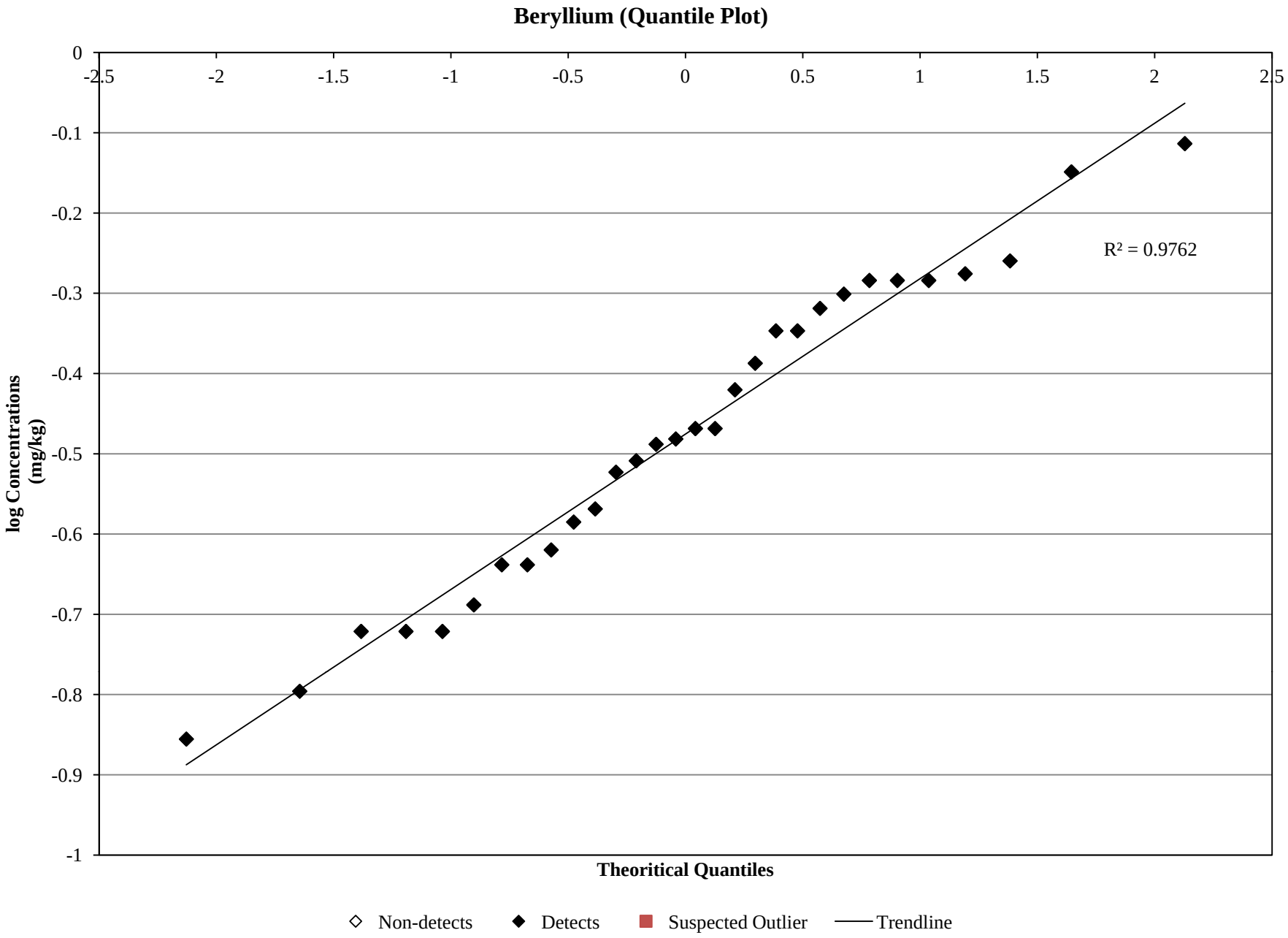
Quantile Plots and Outlier Decision Summary - Metals

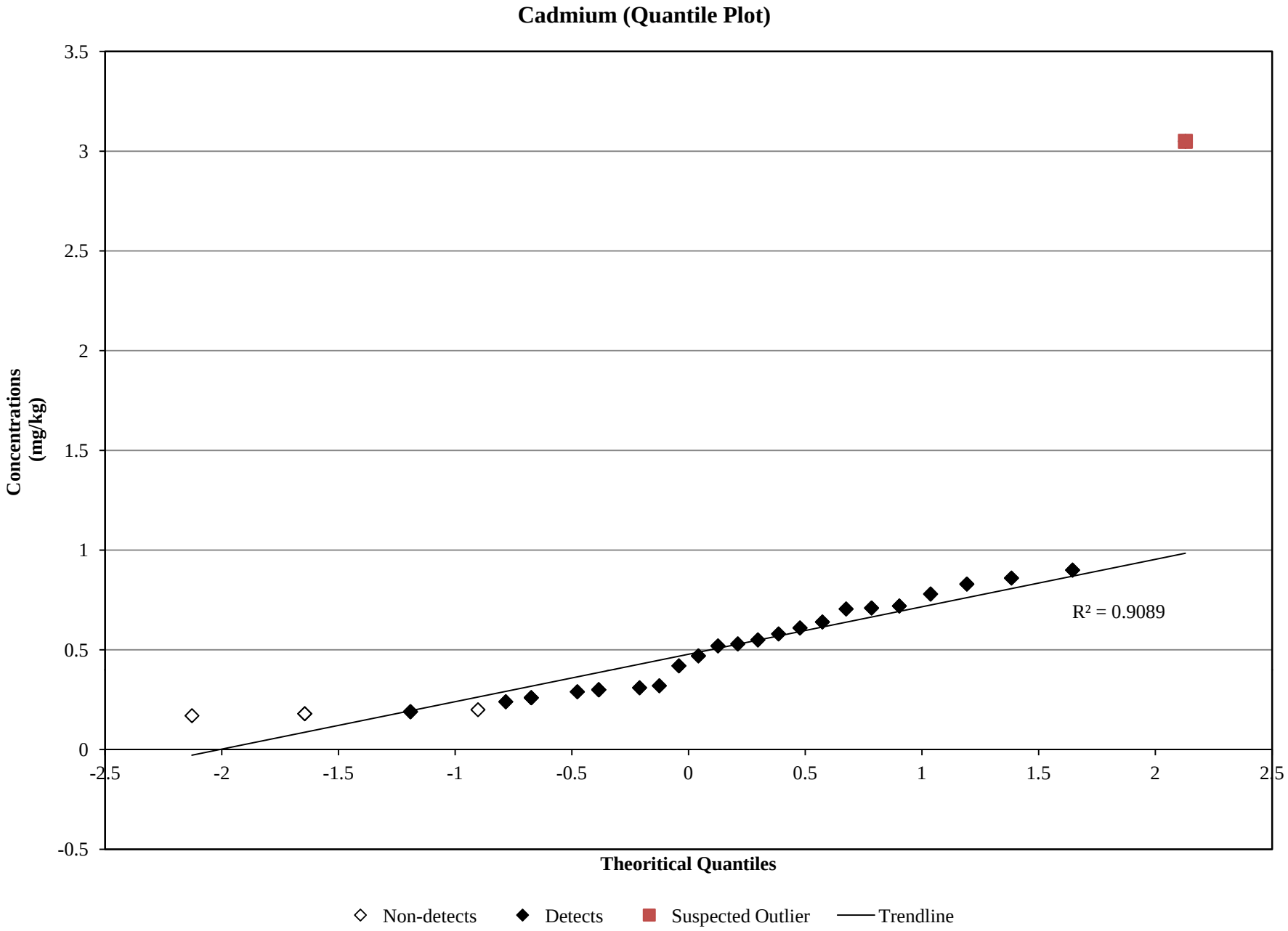

Aluminum (Quantile Plot)
Concentrations (mg/kg)
40000
35000
30000
25000
20000
15000
10000
5000
0
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.9638
Non-detects
Detects
Suspected Outlier
Trendline

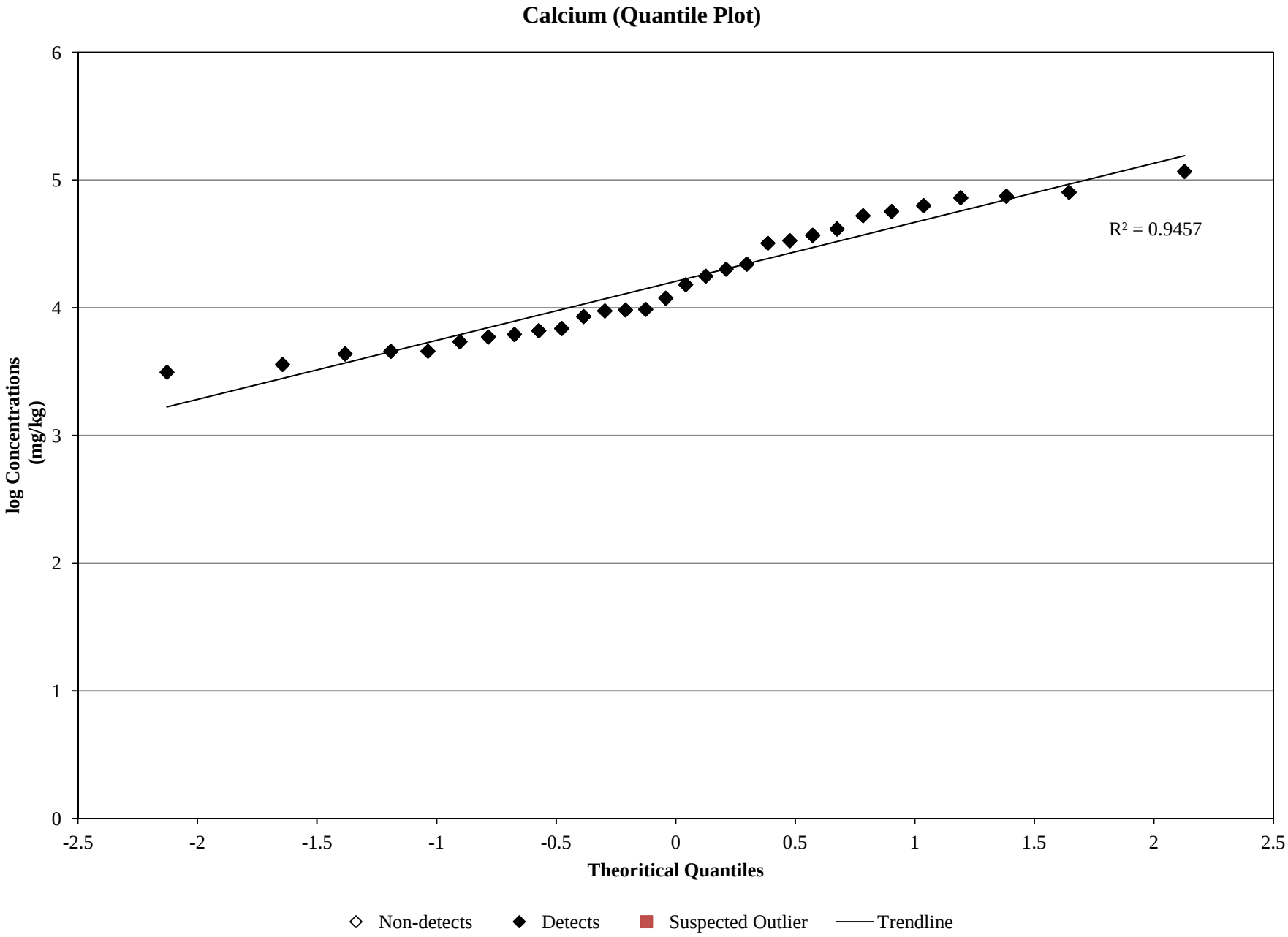

Antimony (Quantile Plot)
log Concentrations (mg/kg)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
R² = 0.9755
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline

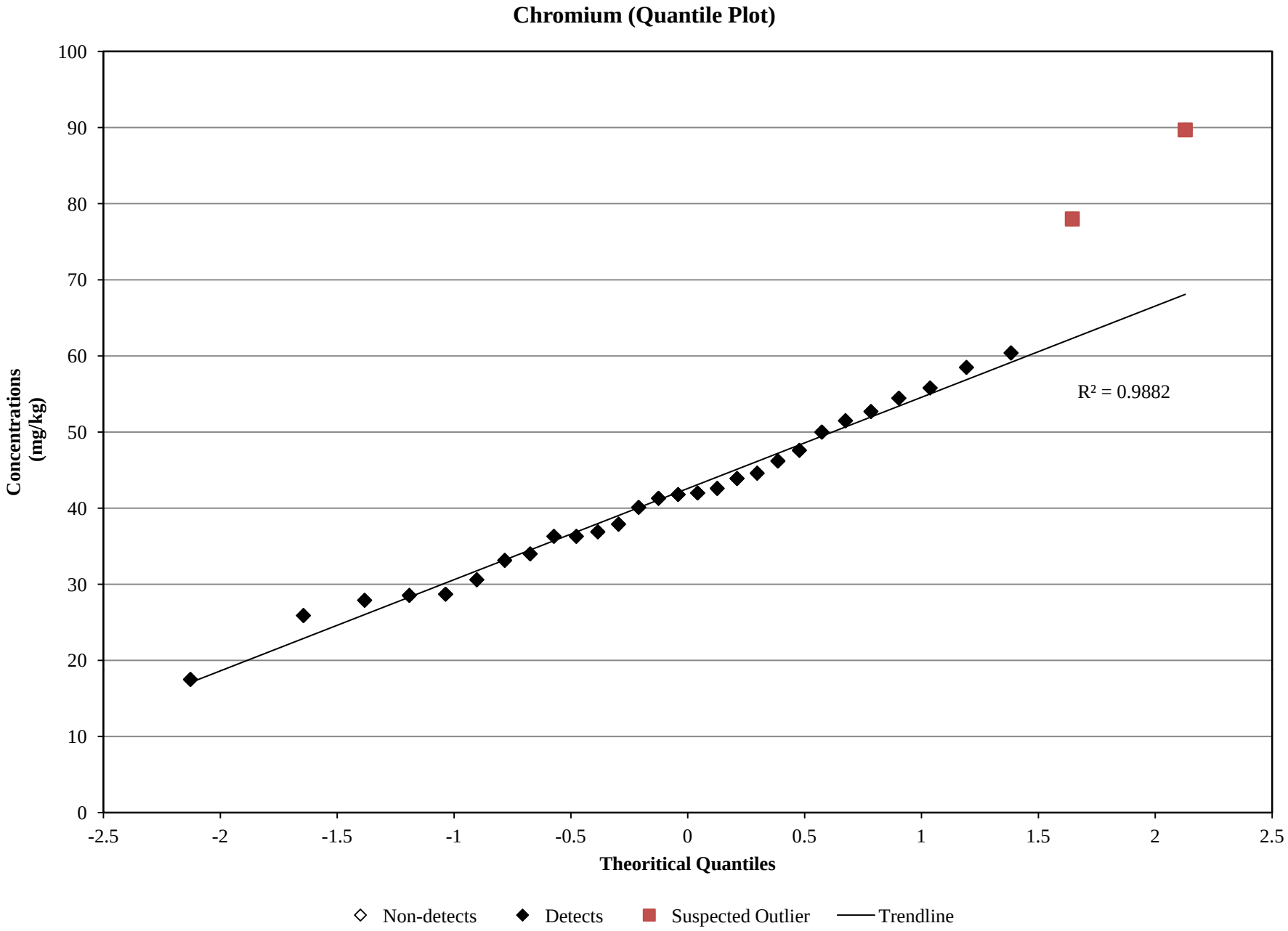

Arsenic (Quantile Plot)
Concentrations (mg/kg)
50
40
30
20
10
0
-10
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
R² = 0.9302
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline

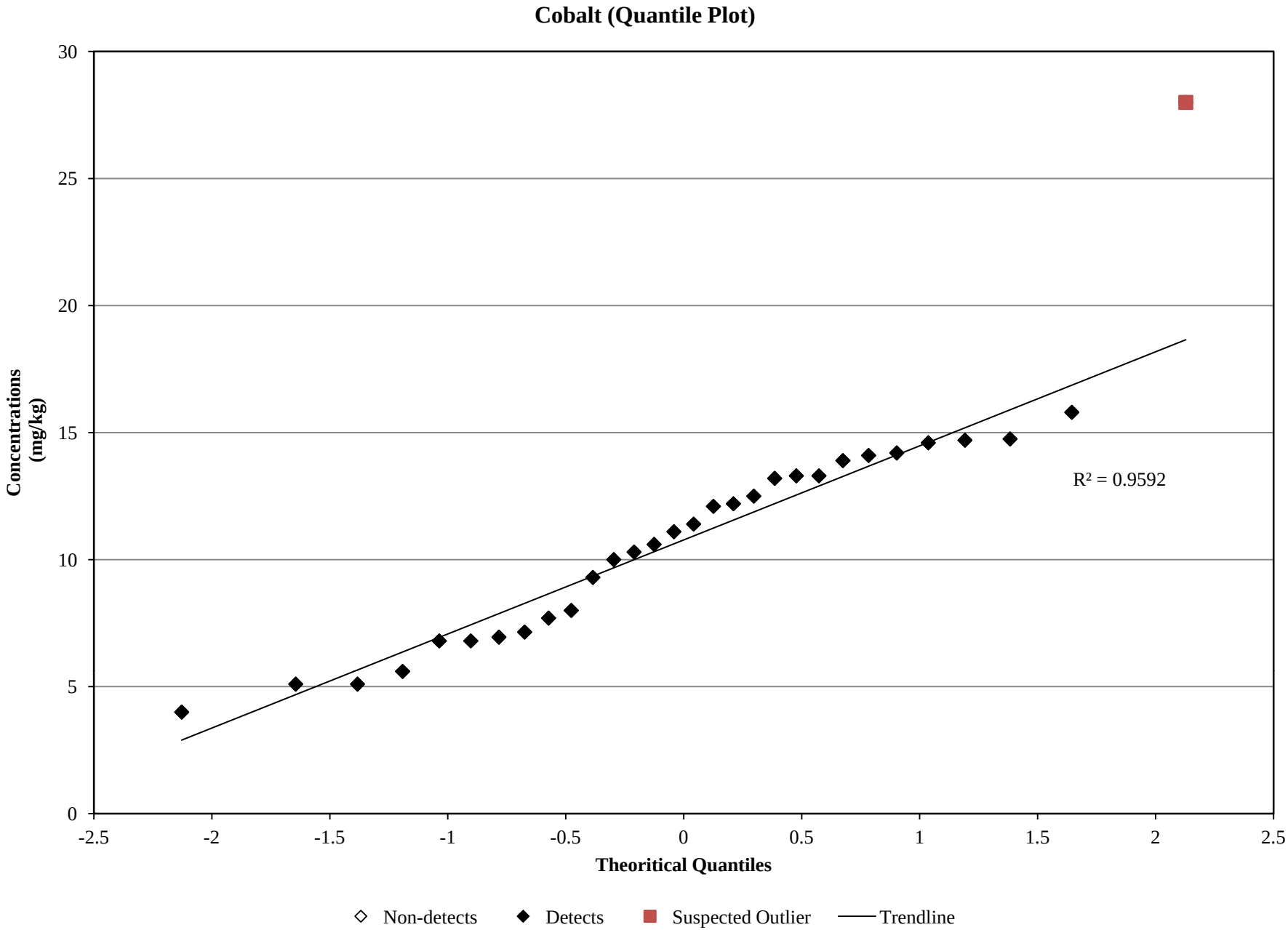

Barium (Quantile Plot)
140
120
100
80
60
40
20
0
Concentrations (mg/kg)
R² = 0.9623
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline

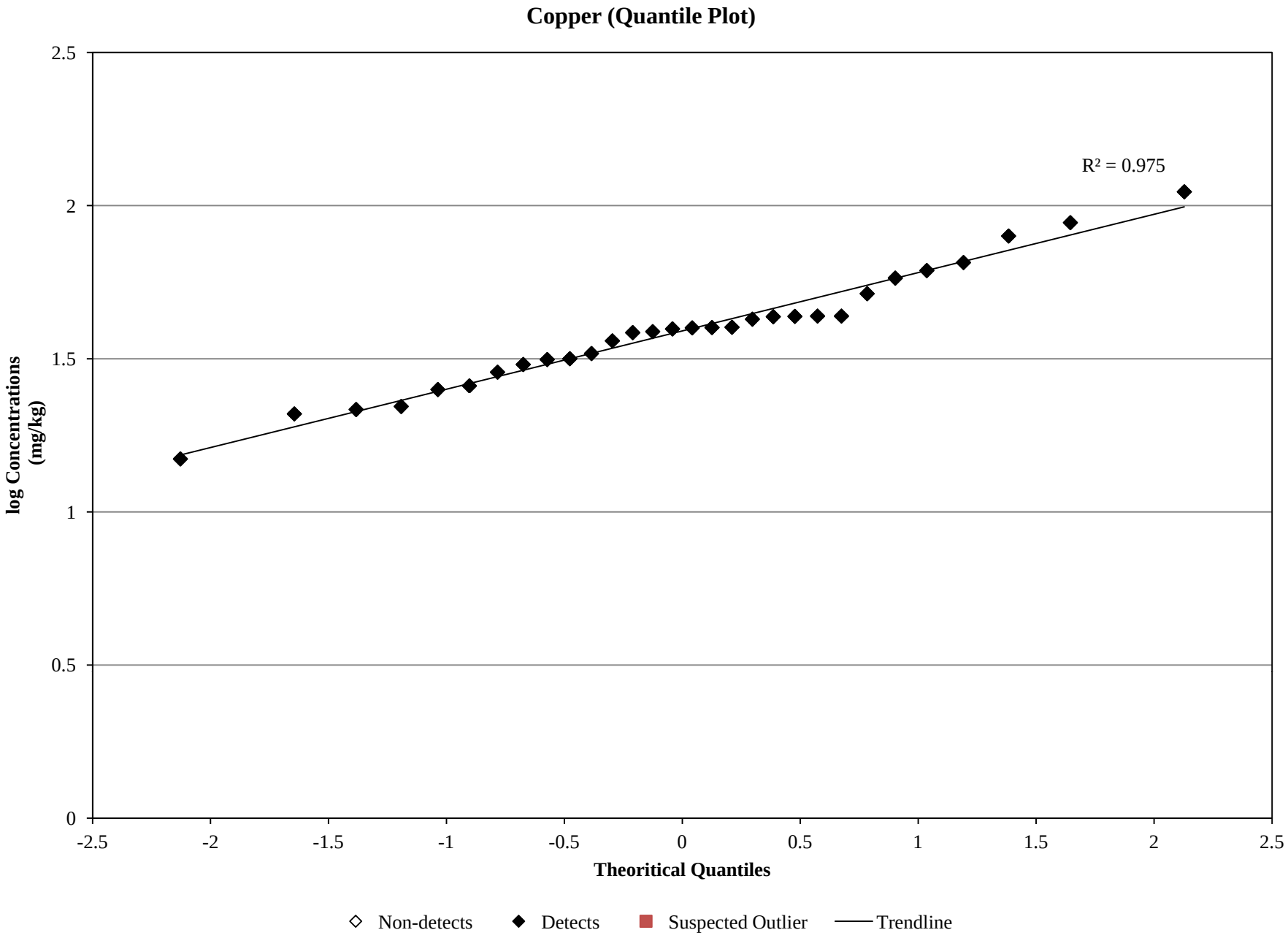

Beryllium (Quantile Plot)
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
log Concentrations (mg/kg)
R² = 0.9762
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline

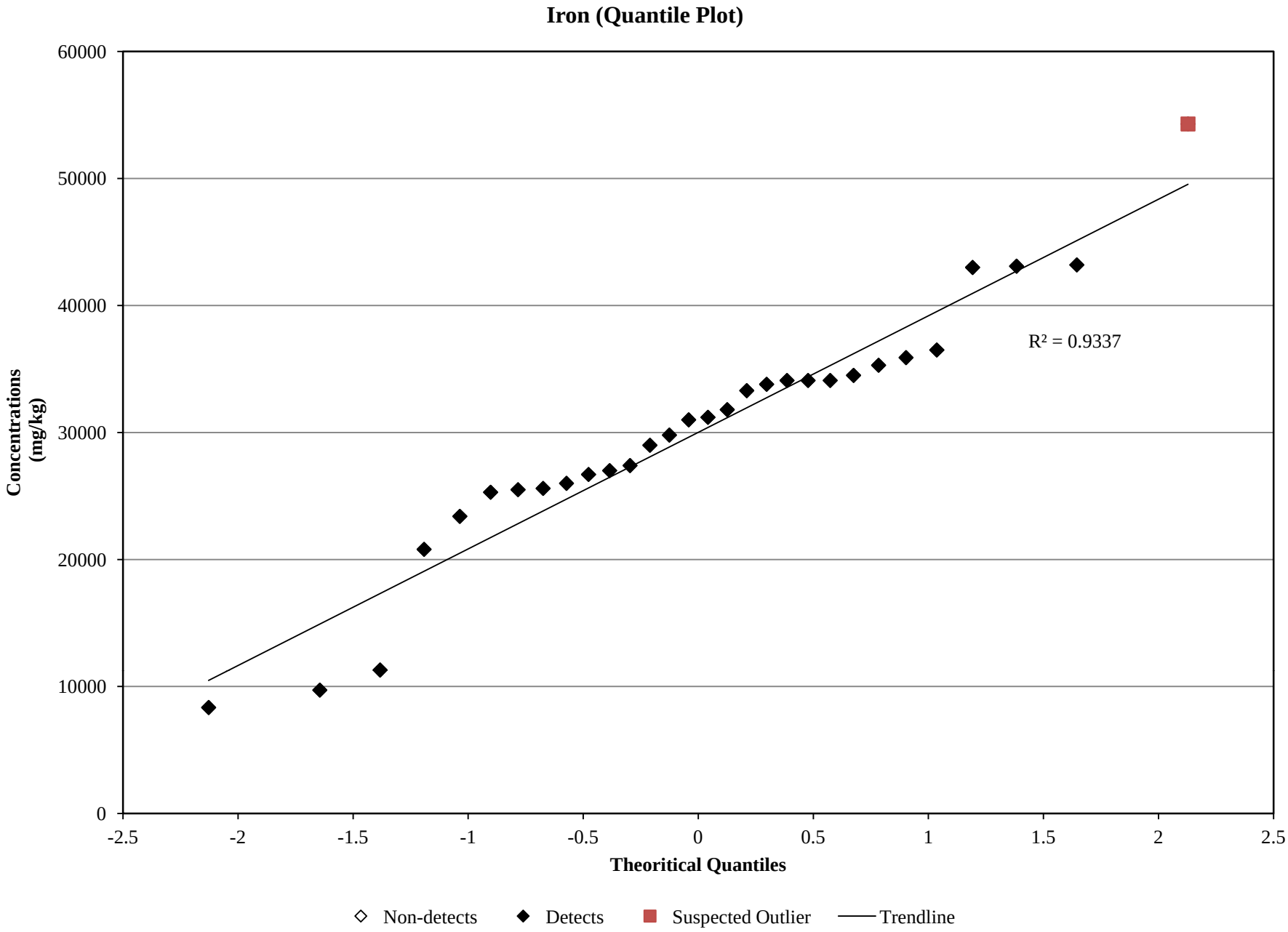

Cadmium (Quantile Plot)
Concentrations (mg/kg)
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.9089
Non-detects
Detects
Suspected Outlier
Trendline

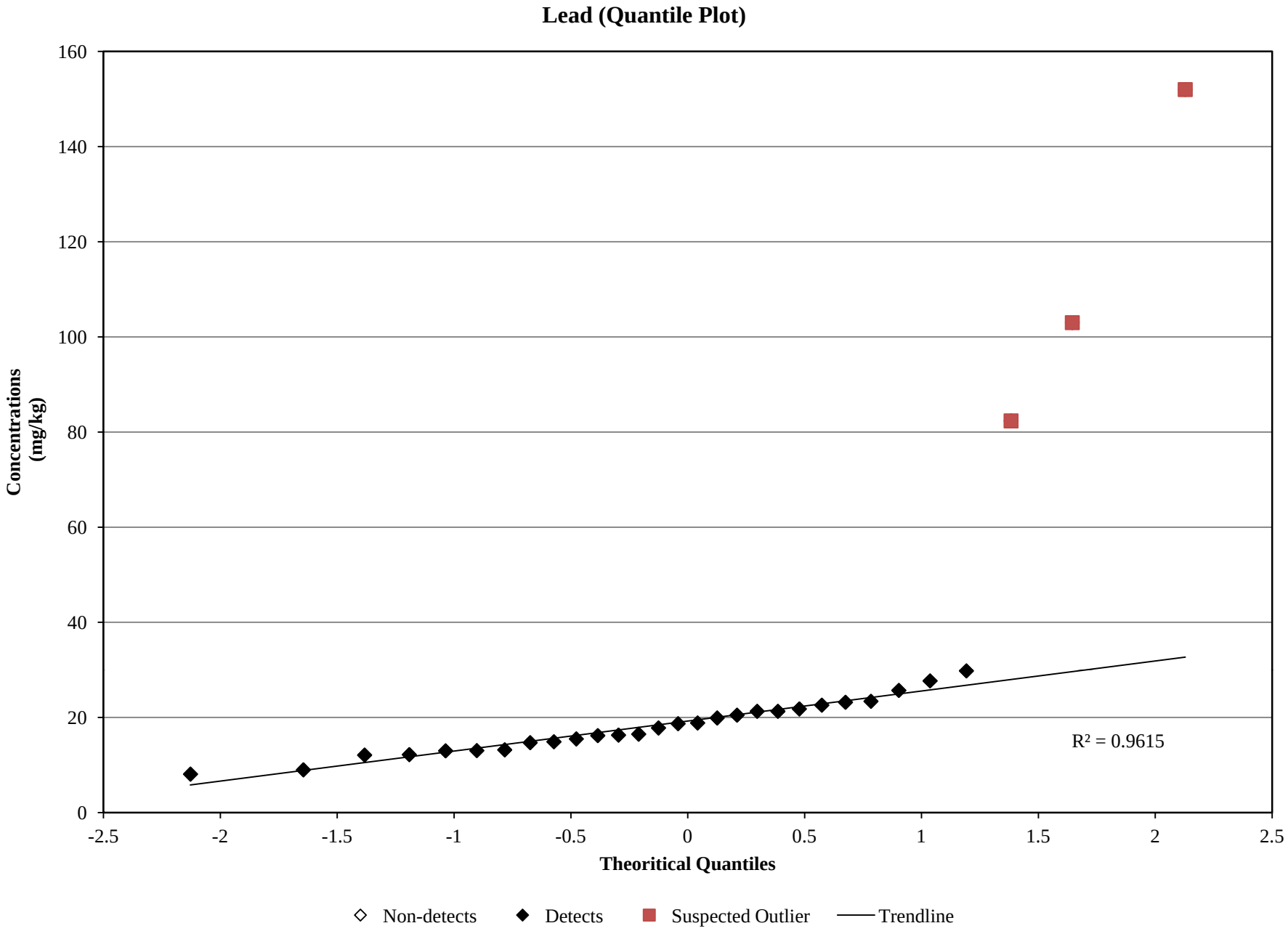

Calcium (Quantile Plot)
log Concentrations (mg/kg)
6
5
4
3
2
1
0
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.9457
Non-detects
Detects
Suspected Outlier
Trendline

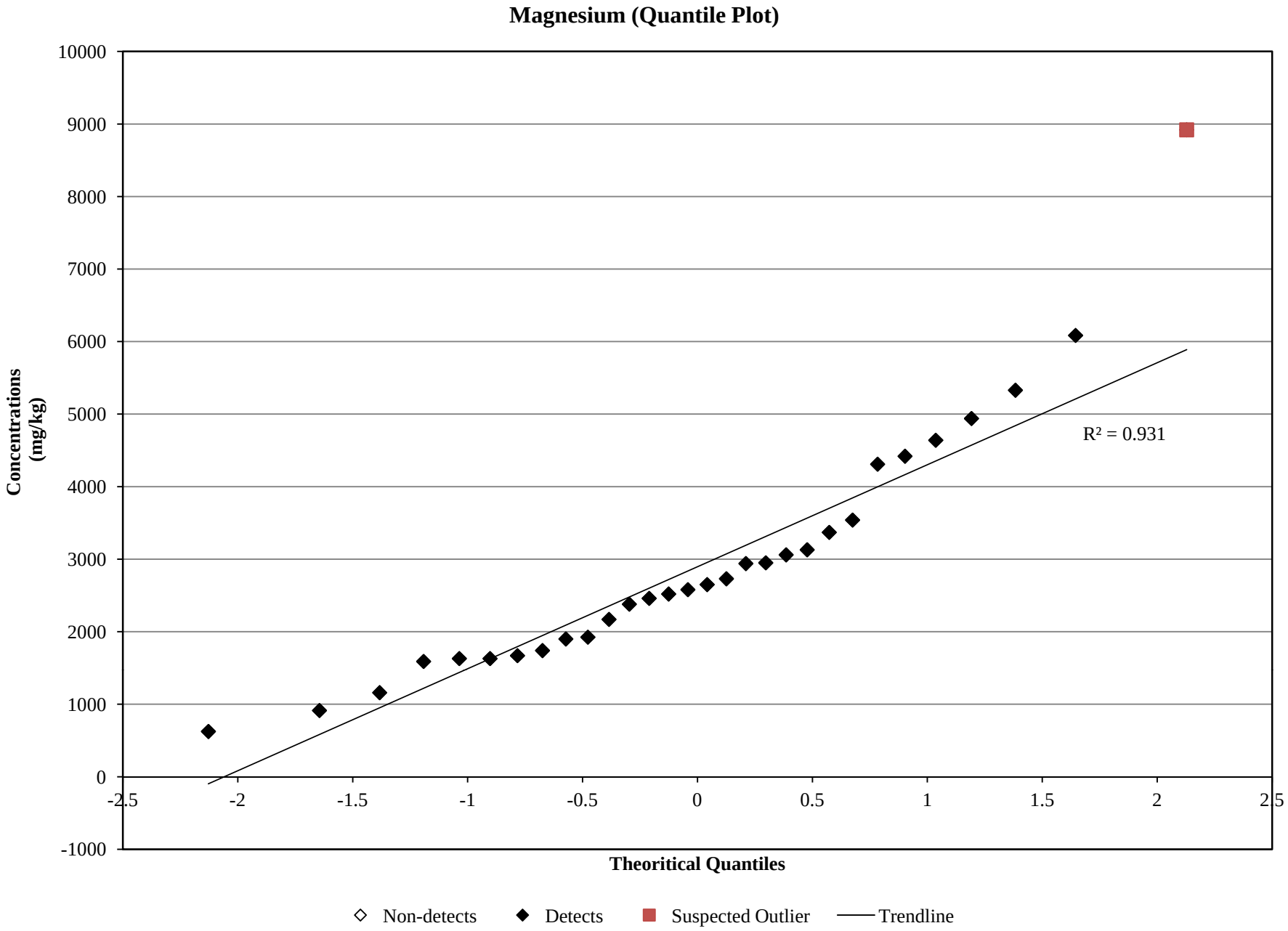

Chromium (Quantile Plot)
Concentrations (mg/kg)
100
90
80
70
60
50
40
30
20
10
0
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.9882
Non-detects
Detects
Suspected Outlier
Trendline

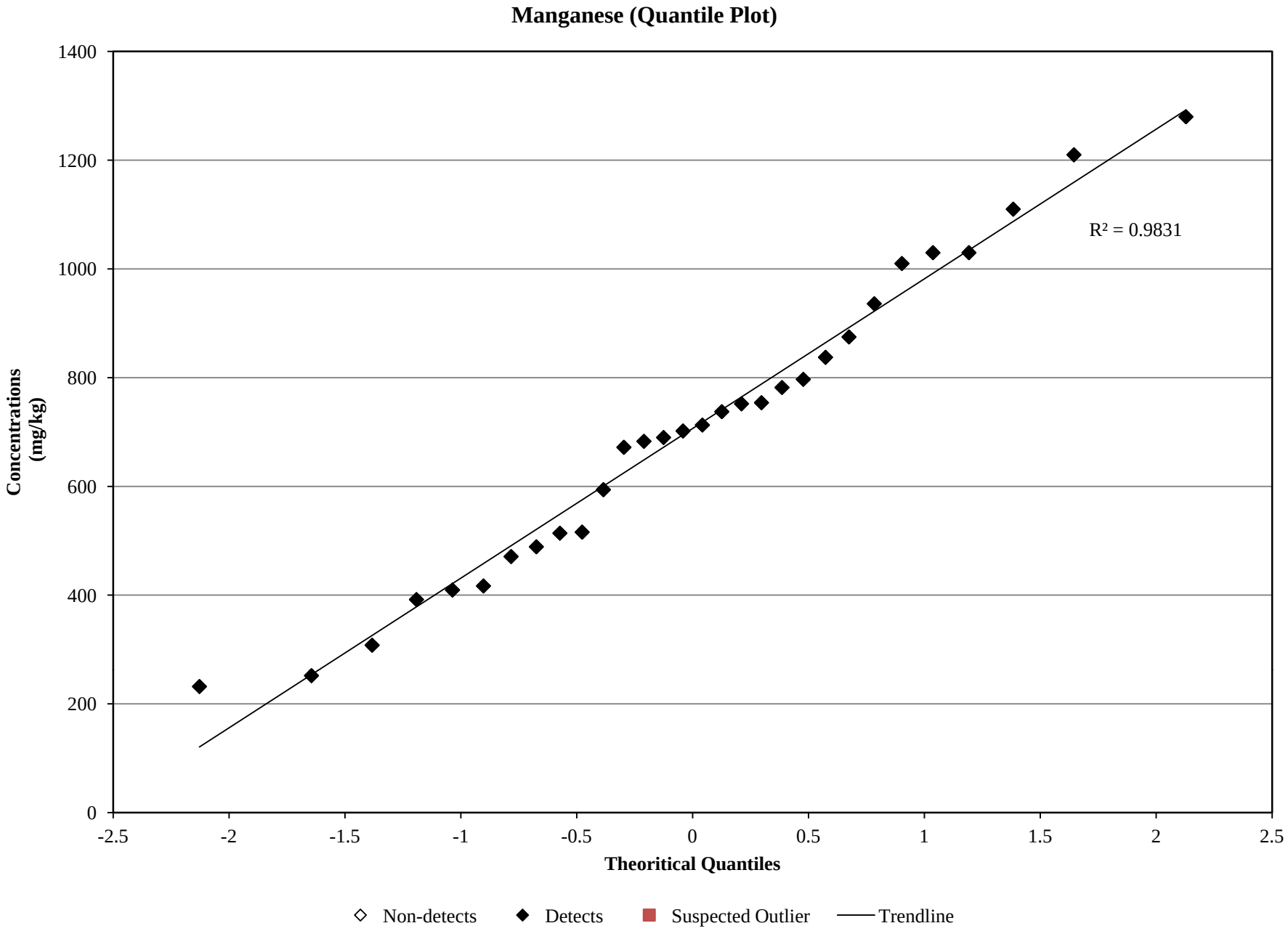

Cobalt (Quantile Plot)
Concentrations (mg/kg)
30
25
20
15
10
5
0
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.9592
Non-detects
Detects
Suspected Outlier
Trendline

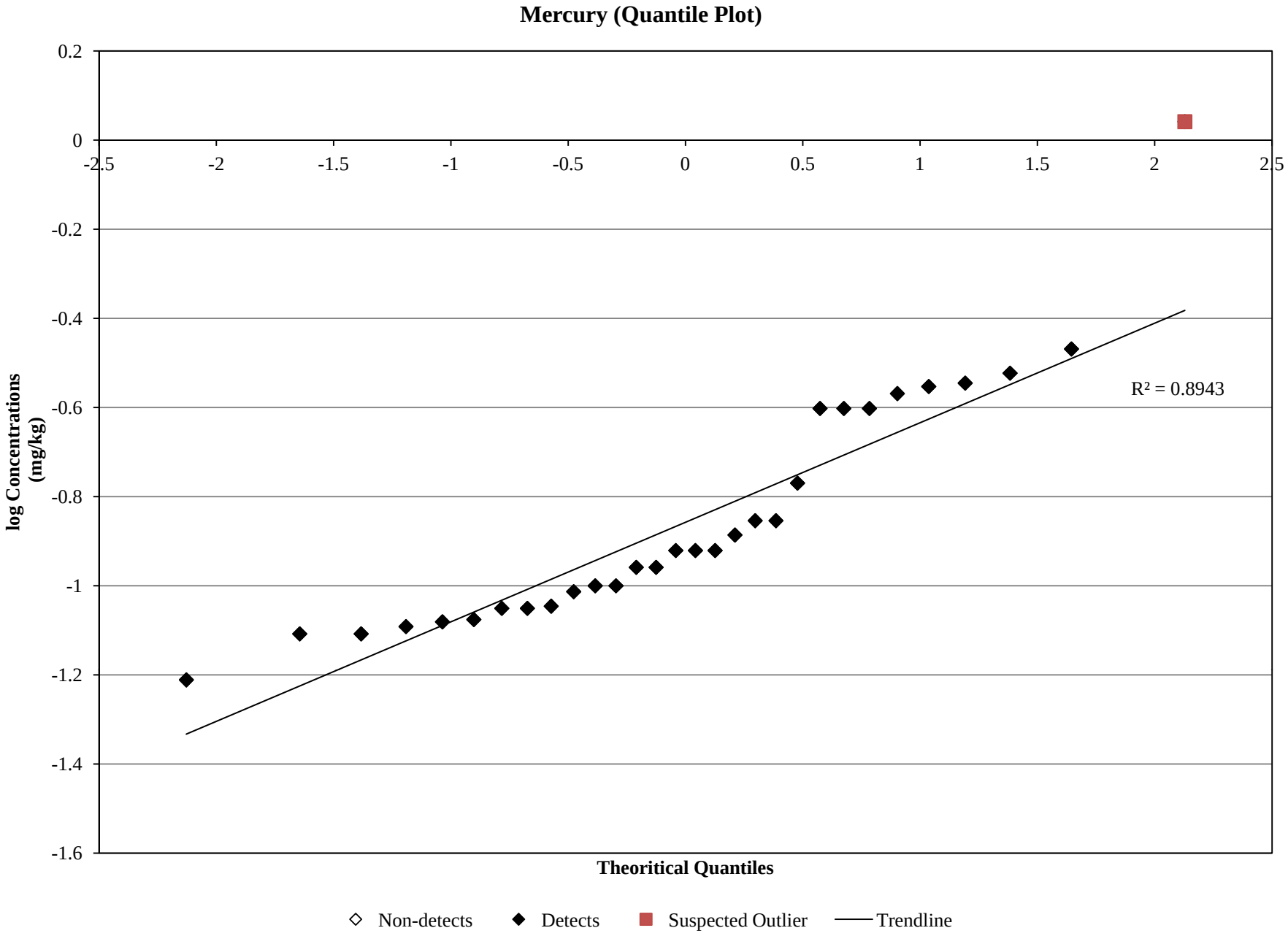

Copper (Quantile Plot)
R² = 0.975
log Concentrations (mg/kg)
2.5
2
1.5
1
0.5
0
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline

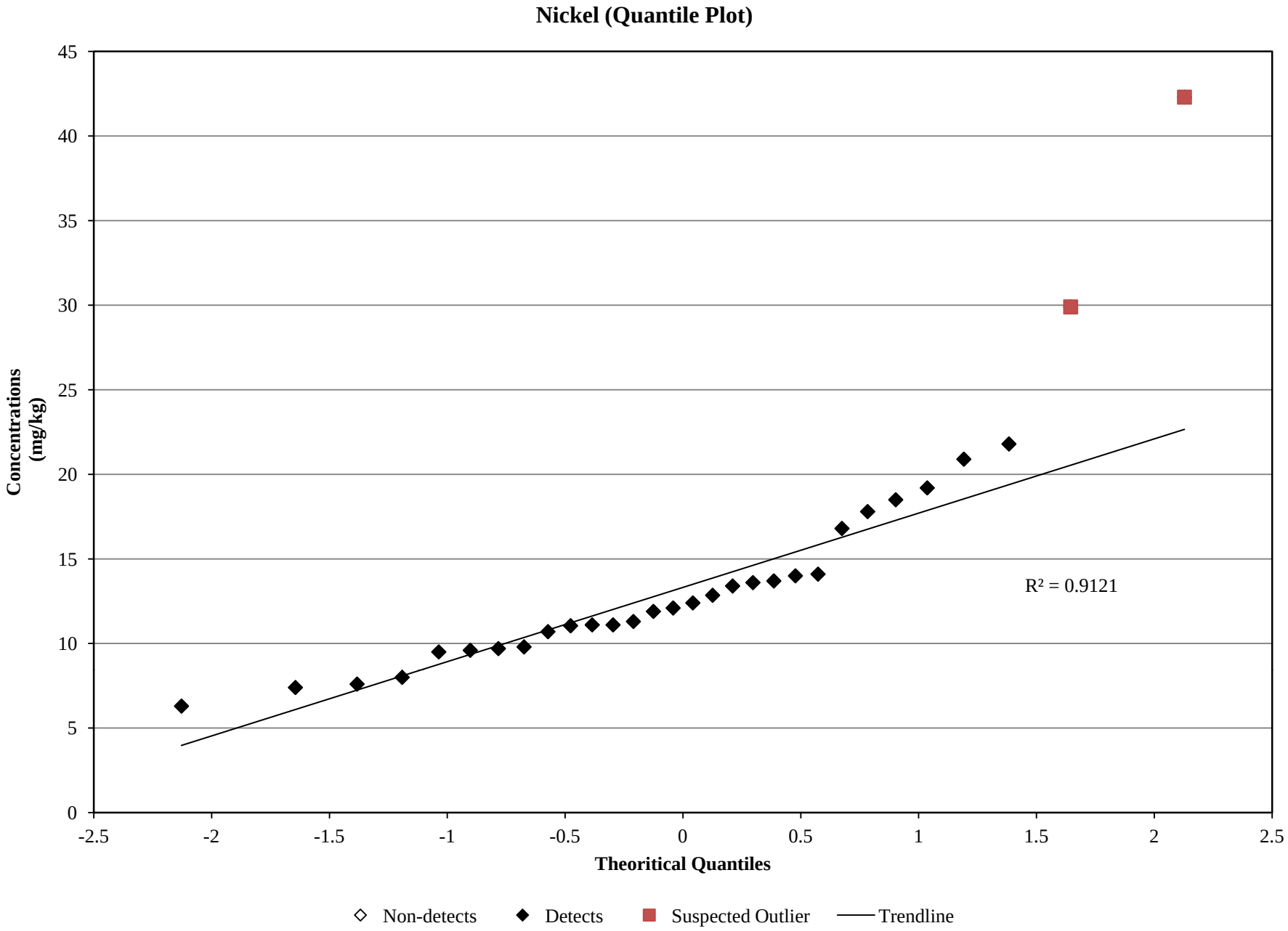

Iron (Quantile Plot)
60000
50000
40000
30000
20000
10000
0
Concentrations (mg/kg)
R² = 0.9337
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline

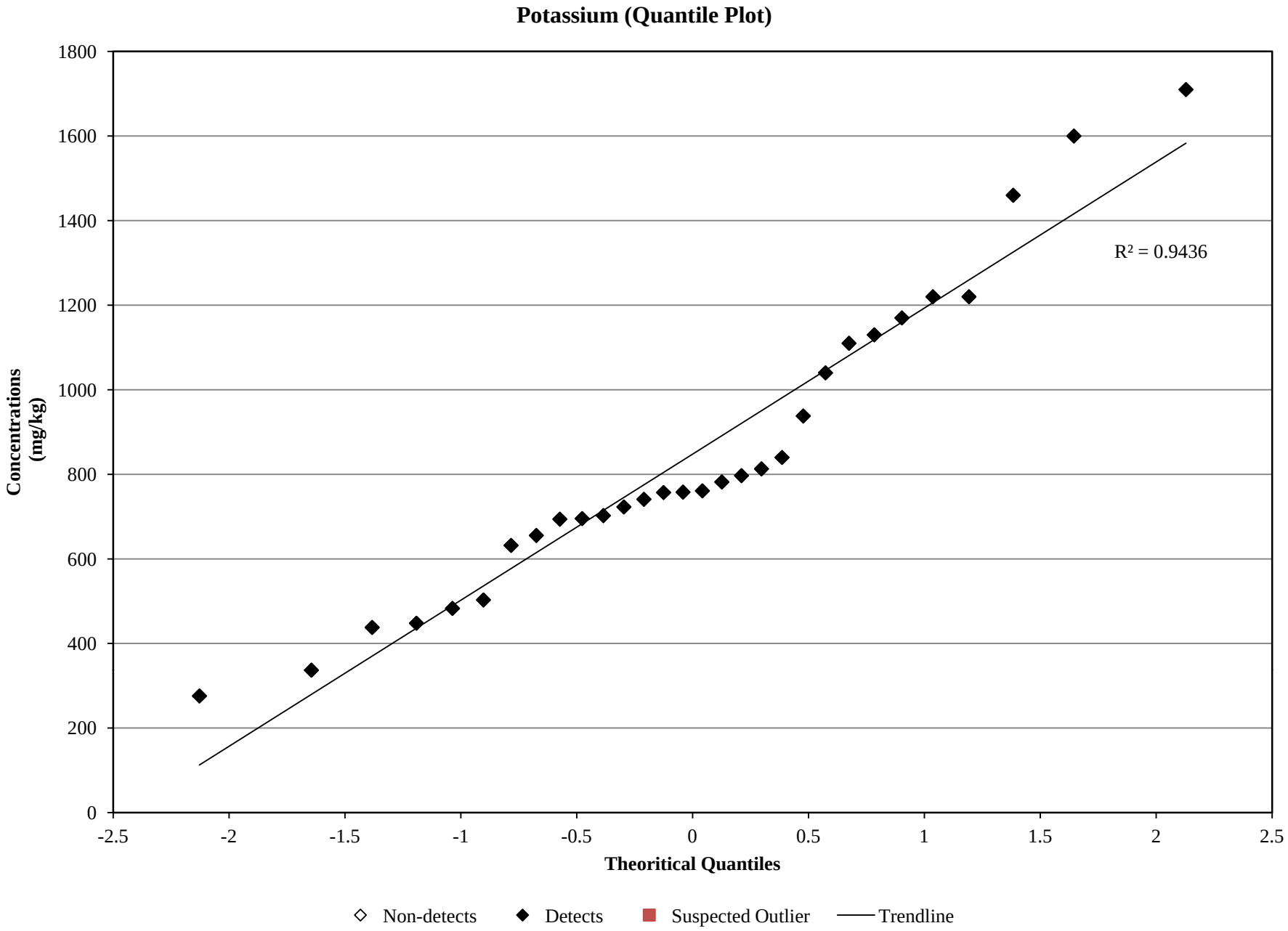

Lead (Quantile Plot)
160
140
120
100
80
60
40
20
0
Concentrations (mg/kg)
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.9615
Non-detects
Detects
Suspected Outlier
Trendline

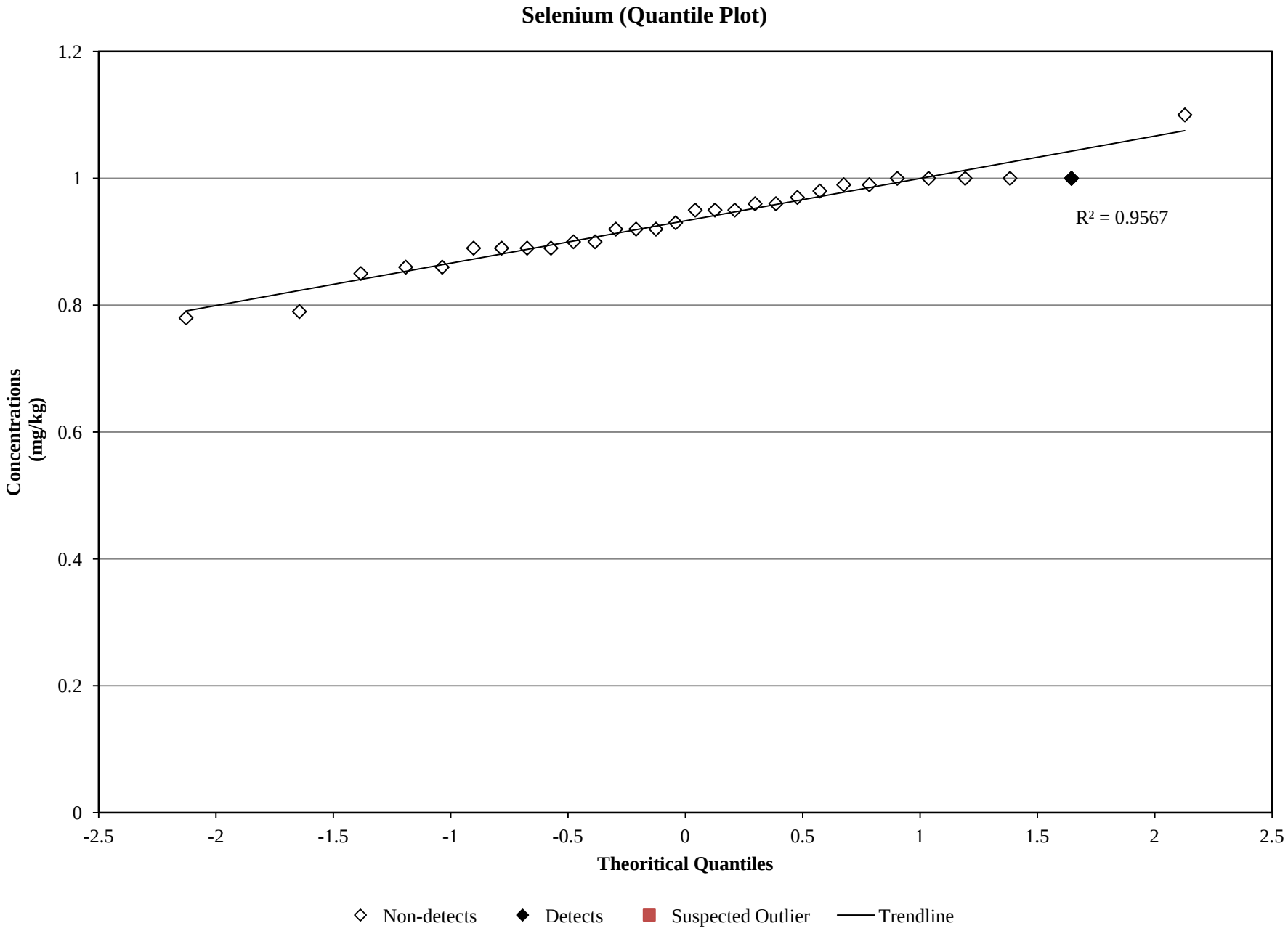

Magnesium (Quantile Plot)
Concentrations (mg/kg)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.931
Non-detects
Detects
Suspected Outlier
Trendline

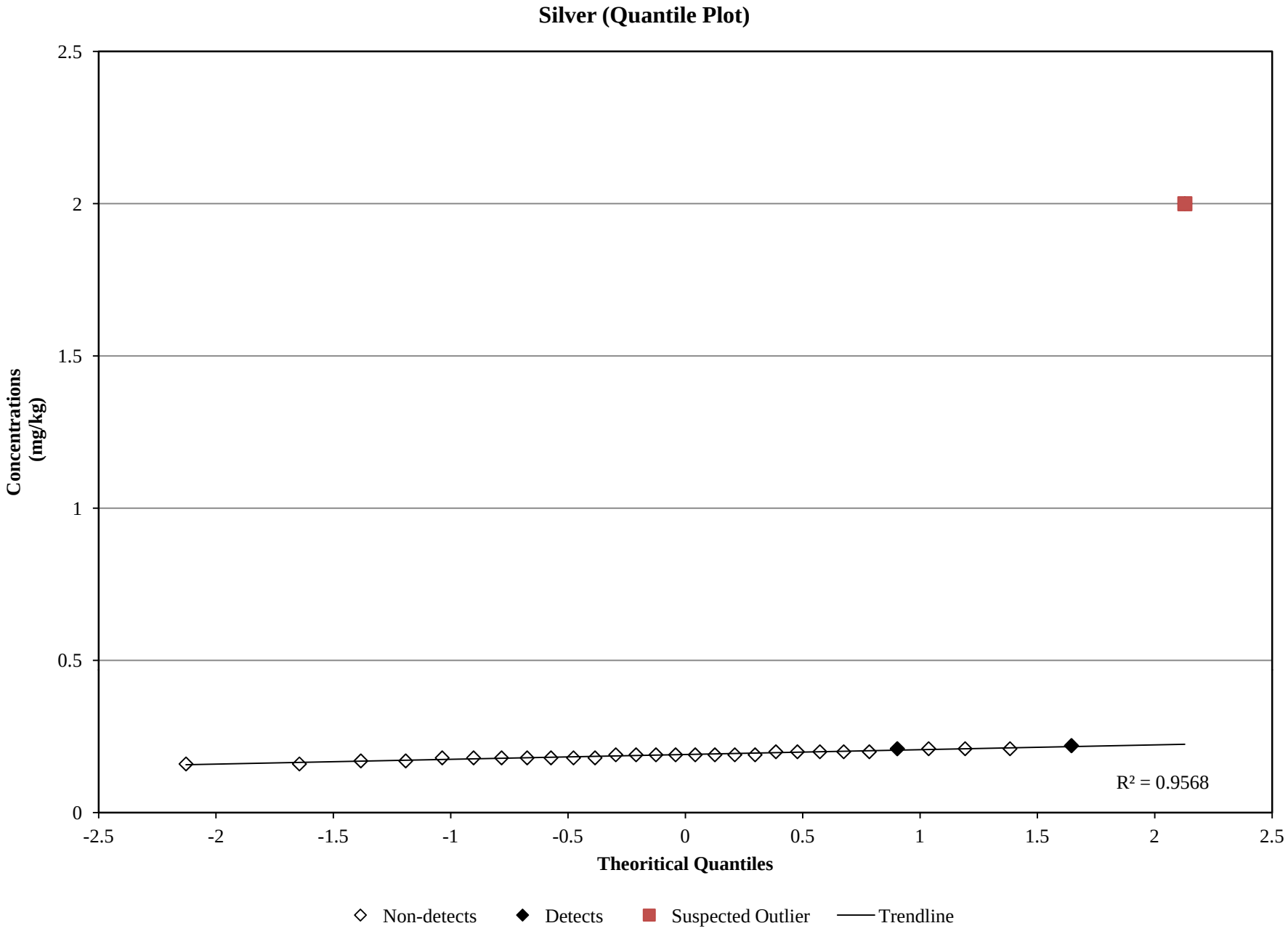

Manganese (Quantile Plot)
1400
1200
1000
800
600
400
200
0
Concentrations (mg/kg)
R² = 0.9831
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline

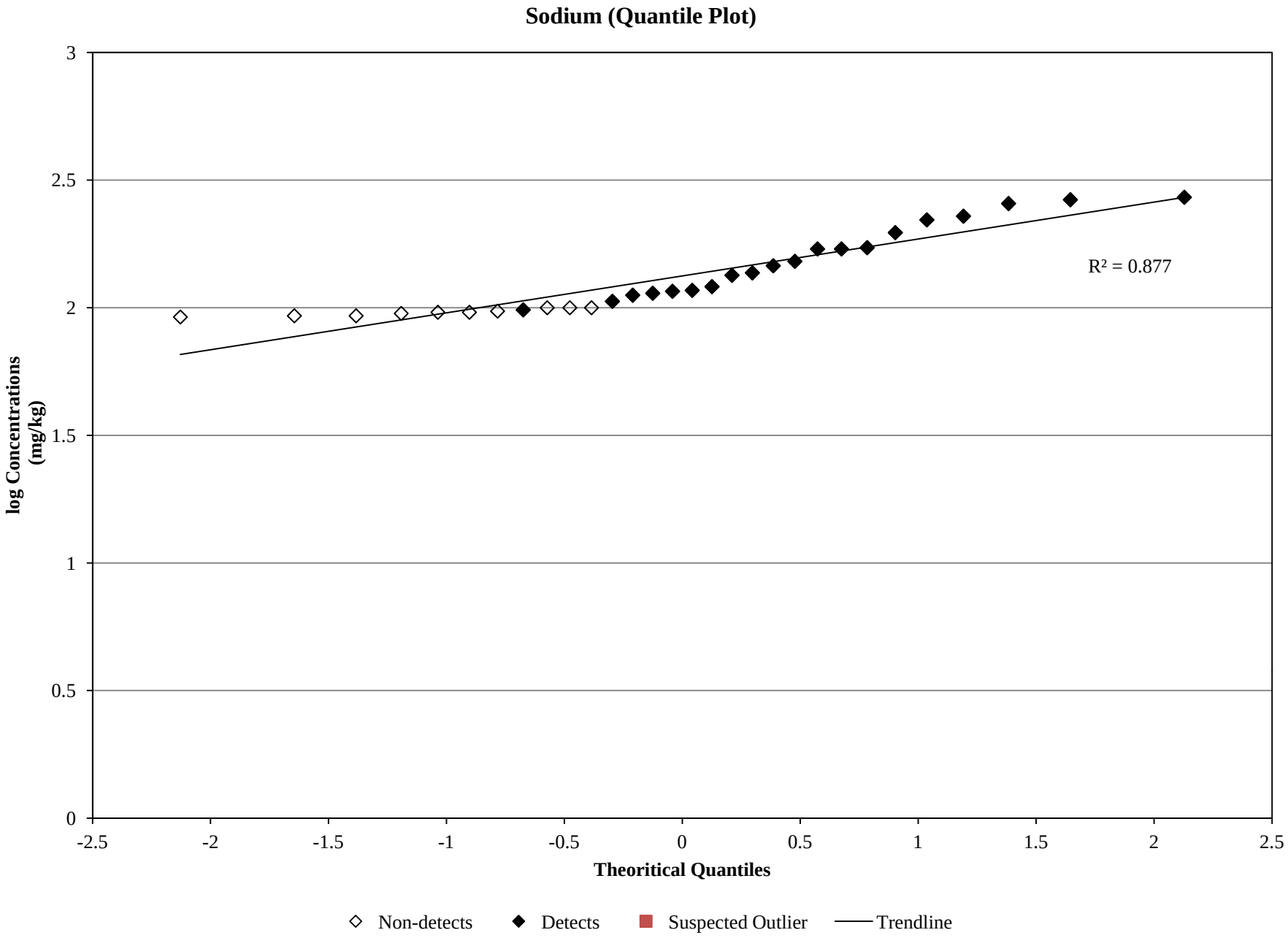

Mercury (Quantile Plot)
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
log Concentrations (mg/kg)
Theoritical Quantiles
R² = 0.8943
Non-detects
Detects
Suspected Outlier
Trendline

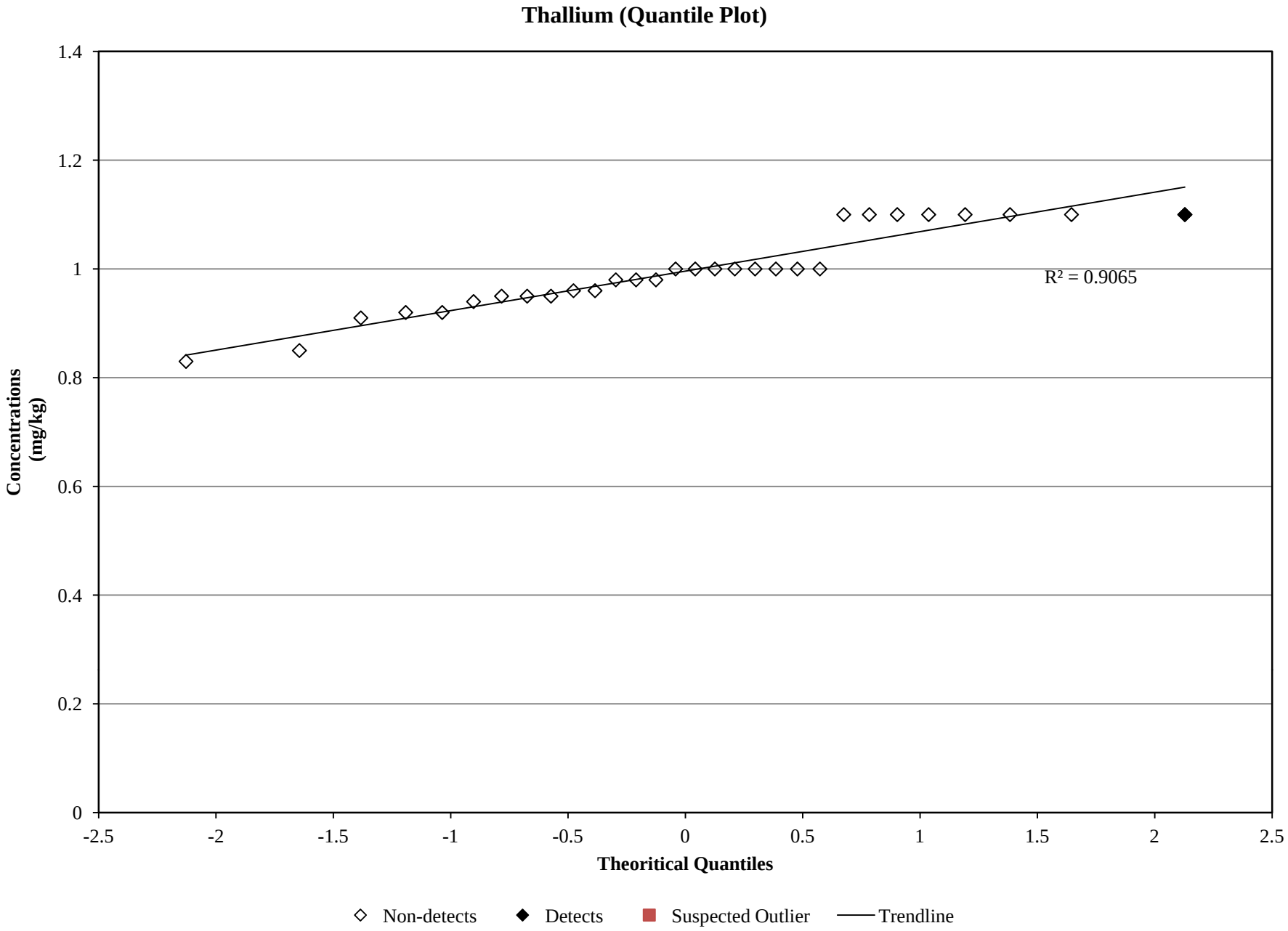

Nickel (Quantile Plot)
Concentrations (mg/kg)
45
40
35
30
25
20
15
10
5
0
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.9121
Non-detects
Detects
Suspected Outlier
Trendline

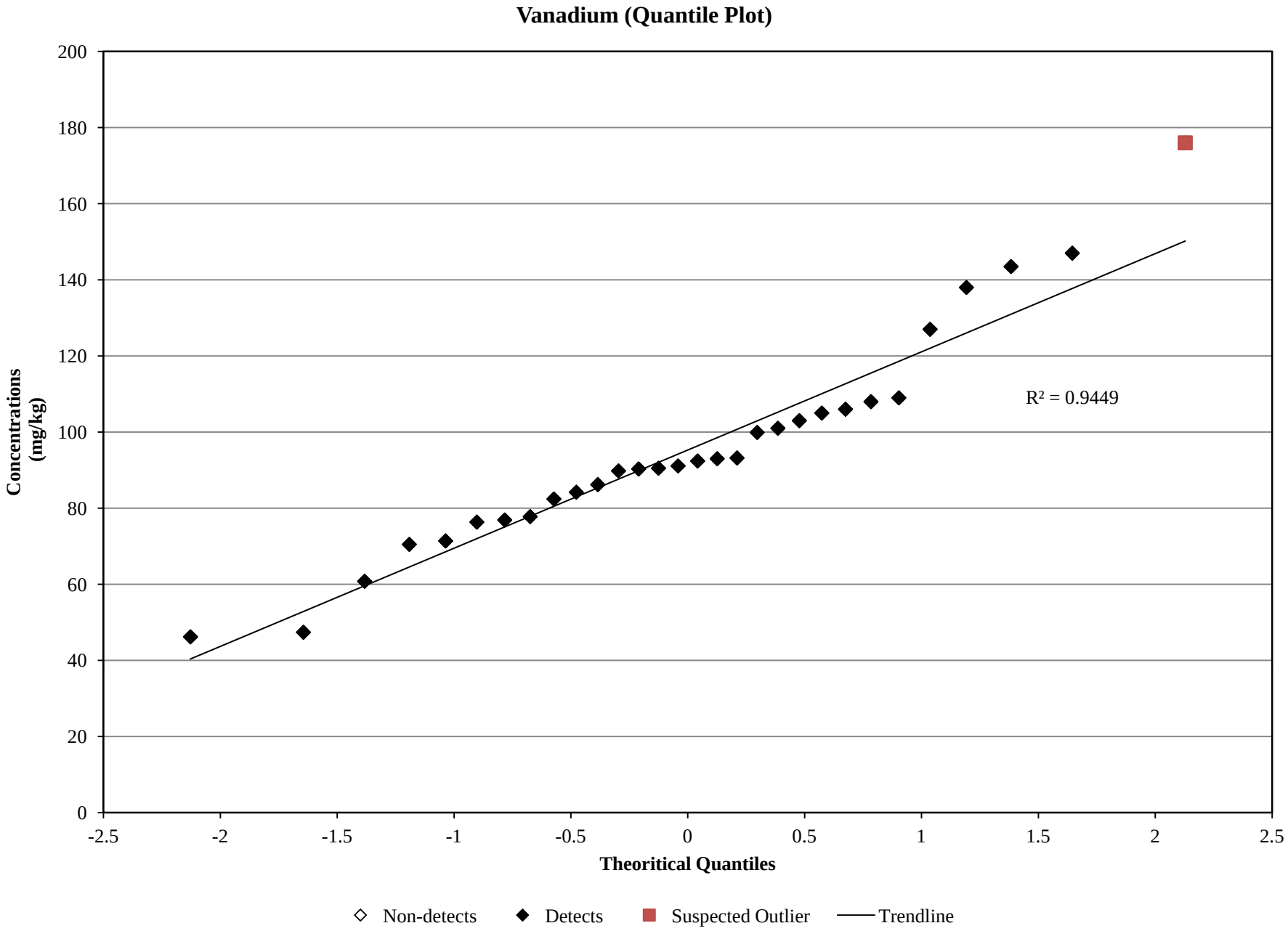

Potassium (Quantile Plot)
Concentrations (mg/kg)
1800
1600
1400
1200
1000
800
600
400
200
0
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.9436
Non-detects
Detects
Suspected Outlier
Trendline

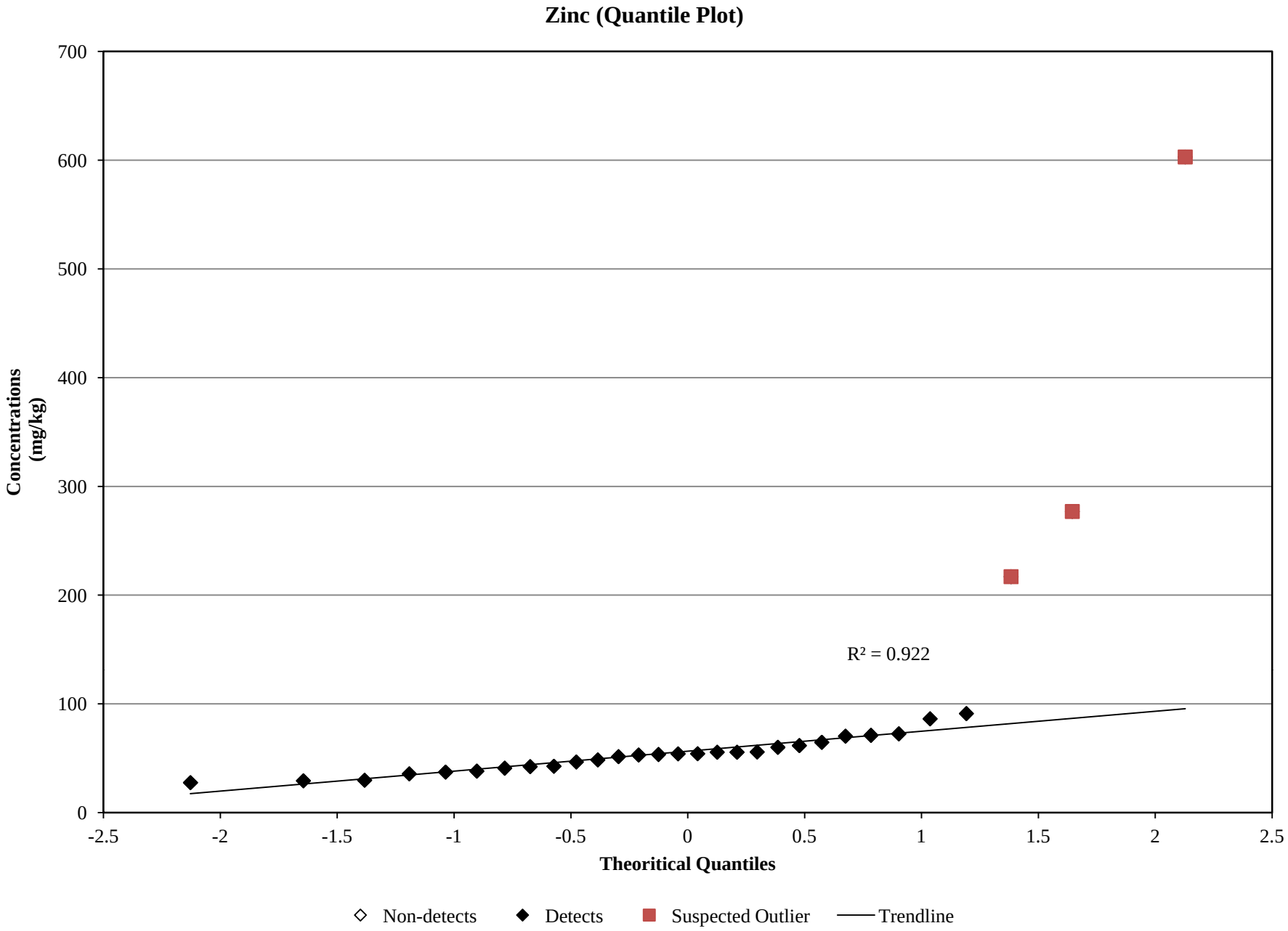

Selenium (Quantile Plot)
1.2
1
0.8
0.6
0.4
0.2
0
Concentrations (mg/kg)
R² = 0.9567
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline


Silver (Quantile Plot)
2.5
2
1.5
1
0.5
0
Concentrations (mg/kg)
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.9568
Non-detects
Detects
Suspected Outlier
Trendline


Sodium (Quantile Plot)
log Concentrations (mg/kg)
3
2.5
2
1.5
1
0.5
0
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.877
Non-detects
Detects
Suspected Outlier
Trendline


Thallium (Quantile Plot)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Concentrations (mg/kg)
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.9065
Non-detects
Detects
Suspected Outlier
Trendline


Vanadium (Quantile Plot)
Concentrations (mg/kg)
200
180
160
140
120
100
80
60
40
20
0
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.9449
Non-detects
Detects
Suspected Outlier
Trendline


Zinc (Quantile Plot)
700
600
500
400
300
200
100
0
Concentrations (mg/kg)
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
Theoritical Quantiles
R² = 0.922
Non-detects
Detects
Suspected Outlier
Trendline

Fort Buchanan Metals Background Outlier Decision

| Analyte | N | Frequency of Detection | Distribution | Maximum Detected Concentration | No. of Suspected Outliers frm Quantile Plot | Suspected Outlier Value | Outlier Evaluation with Rosner or Dixon Test at 99% Significance Level |
|---|---|---|---|---|---|---|---|
| ALUMINUM | 30 | 30/30 | Normal | 34000 | 1 | 34000 | No potential statistical outlier identified. |
| ANTIMONY | 30 | 1/30 | Insufficient detects. | 2.2 | 1 | 2.2 | NA [1] |
| ARSENIC | 30 | 30/30 | Normal | 47.1 | 1 | 47.1 | No potential statistical outlier identified. |
| BARIUM | 30 | 30/30 | Normal | 118 | 1 | 118 | No potential statistical outlier identified. |
| BERYLLIUM | 30 | 30/30 | Lognormal | 0.77 | 0 | NA | No outliers suspected. |
| CADMIUM | 30 | 25/30 | Normal | 3.05 | 1 | 3.05 | Potential statistical outlier identified. |
| CALCIUM | 30 | 30/30 | Lognormal | 117000 | 0 | NA | No outliers suspected. |
| CHROMIUM | 30 | 30/30 | Normal | 89.7 | 2 | 78, 89.7 | No potential statistical outlier identified. |
| COBALT | 30 | 30/30 | Normal | 28 | 1 | 28 | Potential statistical outlier identified. |
| COPPER | 30 | 30/30 | Lognormal | 111 | 0 | NA | No outliers suspected. |
| IRON | 30 | 30/30 | Normal | 54300 | 1 | 54300 | No potential statistical outlier identified. |
| LEAD | 30 | 30/30 | Normal | 152 | 3 | 152, 103, 82.5 | Three potential statistical outliers identified |
| MAGNESIUM | 30 | 30/30 | Normal | 8920 | 1 | 8920 | Potential statistical outlier identified. |
| MANGANESE | 30 | 30/30 | Normal | 1280 | 0 | NA | No outliers suspected. |
| MERCURY | 30 | 30/30 | Lognormal | 1.1 | 1 | 1.1 | Potential statistical outlier identified. |
| NICKEL | 30 | 30/30 | Normal | 42.3 | 2 | 42.3, 29.9 | Two potential statistical outliers identified |
| POTASSIUM | 30 | 30/30 | Normal | 1710 | 0 | NA | No outliers suspected. |
| SELENIUM | 30 | 1/30 | Insufficient detects. | 1 | 0 | NA | No outliers suspected. |
| SILVER | 30 | 3/30 | Insufficient detects. | 2 | 1 | 2 | NA [1] |
| SODIUM | 30 | 20/30 | Lognormal | 271 | 0 | NA | No outliers suspected. |
| THALLIUM | 30 | 2/30 | Insufficient detects. | 1.1 | 0 | NA | No outliers suspected. |
| VANADIUM | 30 | 30/30 | Normal | 176 | 1 | 176 | No potential statistical outlier identified. |
| ZINC | 30 | 30/30 | Normal | 603 | 3 | 603, 277, 217 | Three potential statistical outliers identified |

[1] Rosner or Dixon test could not be conducted due to insufficient detected data. Therefore, results from the quantile plots were used to identify outliers.

# Attachment 3

Goodness of Fit Test - Metals

## Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

**User Selected Options**

| | |
|---|---|
| From File | WorkSheet.wst |
| Full Precision | OFF |
| Confidence Coefficient | 0.95 |

**ALUMINUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 29 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 29 | 14700 | 28700 | 22686 | 22500 | 3523 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 39.77 | 35.68 | 570.4 | 10.02 | 0.165 | 0.0165 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.978 | 0.978 | 0.978 | 0.978 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.951 | 0.926 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.139 | 0.165 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.968 | 0.968 | 0.968 | 0.968 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.701 | 0.744 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.155 | 0.162 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.96 | 0.96 | 0.96 | 0.96 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.919 | 0.926 | Data Not Lognormal |
| Lilliefors (Full: no NDs) | 0.168 | 0.165 | Data Not Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**ANTIMONY**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 0 | 29 | 100.00% |

**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**
**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**
**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**

**The data set for variable ANTIMONY was not processed!**

**ARSENIC**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 29 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 29 | 3 | 33.5 | 15.27 | 14.8 | 8.507 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 2.921 | 2.642 | 5.227 | 2.545 | 0.66 | 0.259 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.974 | 0.974 | 0.974 | 0.974 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.936 | 0.926 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.126 | 0.165 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.979 | 0.979 | 0.979 | 0.979 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.465 | 0.753 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.108 | 0.164 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.969 | 0.969 | 0.969 | 0.969 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.928 | 0.926 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.148 | 0.165 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**BARIUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 29 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 29 | 25.8 | 99.1 | 59.82 | 62.7 | 20.99 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 7.656 | 6.887 | 7.813 | 4.025 | 0.385 | 0.0955 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.983 | 0.983 | 0.983 | 0.983 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.951 | 0.926 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.124 | 0.165 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.972 | 0.972 | 0.972 | 0.972 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.628 | 0.747 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.149 | 0.163 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.973 | 0.973 | 0.973 | 0.973 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.933 | 0.926 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.167 | 0.165 | Data Not Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**BERYLLIUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 28 | 0 | 28 | 28 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 28 | 0.14 | 0.55 | 0.341 | 0.328 | 0.131 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 6.691 | 5.997 | 0.051 | -1.151 | 0.409 | -0.355 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.971 | 0.971 | 0.971 | 0.971 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.923 | 0.924 | Data Not Normal |
| Lilliefors (Full: no NDs) | 0.119 | 0.167 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.961 | 0.961 | 0.961 | 0.961 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.547 | 0.747 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.131 | 0.166 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.976 | 0.976 | 0.976 | 0.976 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.936 | 0.924 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.127 | 0.167 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**CADMIUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 24 | 5 | 17.24% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Non-Detects Only) | 5 | 0.17 | 0.2 | 0.184 | 0.18 | 0.0114 |
| Statistics (Detects Only) | 24 | 0.19 | 0.9 | 0.512 | 0.525 | 0.222 |
| Statistics (All: NDs treated as DL value) | 29 | 0.17 | 0.9 | 0.456 | 0.42 | 0.237 |
| Statistics (All: NDs treated as DL/2 value) | 29 | 0.085 | 0.9 | 0.44 | 0.42 | 0.258 |
| Statistics (Normal ROS Estimated Data) | 29 | -0.0526 | 0.9 | 0.427 | 0.42 | 0.278 |
| Statistics (Gamma ROS Estimated Data) | 29 | 0.107 | 0.9 | 0.455 | 0.42 | 0.238 |
| Statistics (Lognormal ROS Estimated Data) | 29 | 0.144 | 0.9 | 0.453 | 0.42 | 0.241 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Detects Only) | 5.178 | 4.665 | 0.0989 | -0.769 | 0.47 | -0.611 |
| Statistics (NDs = DL) | 3.675 | 3.317 | 0.124 | -0.928 | 0.556 | -0.599 |
| Statistics (NDs = DL/2) | 2.363 | 2.141 | 0.186 | -1.048 | 0.755 | -0.72 |
| Statistics (Gamma ROS Estimates) | 3.519 | 3.178 | 0.129 | -- | -- | -- |
| Statistics (Lognormal ROS Estimates) | -- | -- | -- | -0.946 | 0.583 | -0.616 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.973 | 0.96 | 0.975 | 0.986 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Detects Only) | 0.93 | 0.916 | Data Appear Normal |
| Lilliefors (Detects Only) | 0.182 | 0.181 | Data Not Normal |
| Shapiro-Wilks (NDs = DL) | 0.901 | 0.926 | Data Not Normal |
| Lilliefors (NDs = DL) | 0.199 | 0.165 | Data Not Normal |
| Shapiro-Wilks (NDs = DL/2) | 0.931 | 0.926 | Data Appear Normal |
| Lilliefors (NDs = DL/2) | 0.162 | 0.165 | Data Appear Normal |
| Shapiro-Wilks (Normal ROS Estimates) | 0.955 | 0.926 | Data Appear Normal |
| Lilliefors (Normal ROS Estimates) | 0.132 | 0.165 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.967 | 0.965 | 0.953 | 0.967 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Detects Only) | 0.641 | 0.746 | |
| Kolmogorov-Smirnov (Detects Only) | 0.175 | 0.178 | Data Appear Gamma Distributed |
| Anderson-Darling (NDs = DL) | 0.822 | 0.751 | |
| Kolmogorov-Smirnov (NDs = DL) | 0.16 | 0.164 | Data appear Approximate Gamma Distribution |
| Anderson-Darling (NDs = DL/2) | 0.699 | 0.756 | |
| Kolmogorov-Smirnov (NDs = DL/2) | 0.133 | 0.164 | Data Appear Gamma Distributed |
| Anderson-Darling (Gamma ROS Estimates) | 0.621 | 0.751 | |
| Kolmogorov-Smirnov (Gamma ROS Est.) | 0.153 | 0.164 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.971 | 0.967 | 0.952 | 0.972 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Detects Only) | 0.928 | 0.916 | Data Appear Lognormal |
| Lilliefors (Detects Only) | 0.16 | 0.181 | Data Appear Lognormal |
| Shapiro-Wilks (NDs = DL) | 0.912 | 0.926 | Data Not Lognormal |
| Lilliefors (NDs = DL) | 0.137 | 0.165 | Data Appear Lognormal |
| Shapiro-Wilks (NDs = DL/2) | 0.887 | 0.926 | Data Not Lognormal |
| Lilliefors (NDs = DL/2) | 0.147 | 0.165 | Data Appear Lognormal |
| Shapiro-Wilks (Lognormal ROS Estimates) | 0.924 | 0.926 | Data Not Lognormal |
| Lilliefors (Lognormal ROS Estimates) | 0.14 | 0.165 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**CALCIUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 29 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 29 | 3130 | 80300 | 24832 | 11900 | 24564 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 1.134 | 1.039 | 21905 | 9.618 | 1.042 | 0.108 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.904 | 0.904 | 0.904 | 0.904 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.803 | 0.926 | Data Not Normal |
| Lilliefors (Full: no NDs) | 0.218 | 0.165 | Data Not Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.966 | 0.966 | 0.966 | 0.966 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 1.032 | 0.771 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.185 | 0.167 | Data Not Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.971 | 0.971 | 0.971 | 0.971 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.922 | 0.926 | Data Not Lognormal |
| Lilliefors (Full: no NDs) | 0.145 | 0.165 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**CHROMIUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 29 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 29 | 17.5 | 78 | 42.25 | 41.8 | 12.51 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 11.68 | 10.49 | 3.617 | 3.7 | 0.306 | 0.0827 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.982 | 0.982 | 0.982 | 0.982 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.976 | 0.926 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.0805 | 0.165 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.992 | 0.992 | 0.992 | 0.992 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.137 | 0.745 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.0662 | 0.162 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.986 | 0.986 | 0.986 | 0.986 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.983 | 0.926 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.0858 | 0.165 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**COBALT**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 29 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 29 | 4 | 15.8 | 10.5 | 11.1 | 3.505 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 7.904 | 7.11 | 1.329 | 2.287 | 0.385 | 0.168 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.974 | 0.974 | 0.974 | 0.974 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.931 | 0.926 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.124 | 0.165 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.944 | 0.944 | 0.944 | 0.944 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.897 | 0.746 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.149 | 0.163 | Data appear Approximate Gamma Distribution |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.955 | 0.955 | 0.955 | 0.955 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.902 | 0.926 | Data Not Lognormal |
| Lilliefors (Full: no NDs) | 0.152 | 0.165 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**COPPER**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 29 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 29 | 14.9 | 88 | 40.65 | 39.6 | 16.88 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 6.577 | 5.919 | 6.181 | 3.627 | 0.402 | 0.111 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.951 | 0.951 | 0.951 | 0.951 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.909 | 0.926 | Data Not Normal |
| Lilliefors (Full: no NDs) | 0.224 | 0.165 | Data Not Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.982 | 0.982 | 0.982 | 0.982 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.397 | 0.747 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.171 | 0.163 | Data appear Approximate Gamma Distribution |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.988 | 0.988 | 0.988 | 0.988 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.979 | 0.926 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.15 | 0.165 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**IRON**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 29 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 29 | 8350 | 43200 | 29337 | 31000 | 8808 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 8.072 | 7.26 | 3634 | 10.22 | 0.404 | 0.0395 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.96 | 0.96 | 0.96 | 0.96 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.917 | 0.926 | Data Not Normal |
| Lilliefors (Full: no NDs) | 0.151 | 0.165 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.923 | 0.923 | 0.923 | 0.923 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 1.673 | 0.746 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.213 | 0.163 | Data Not Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.88 | 0.88 | 0.88 | 0.88 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.779 | 0.926 | Data Not Lognormal |
| Lilliefors (Full: no NDs) | 0.244 | 0.165 | Data Not Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**LEAD**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 27 | 0 | 27 | 27 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 27 | 8.1 | 29.8 | 18.05 | 17.8 | 5.45 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 10.77 | 9.598 | 1.676 | 2.846 | 0.321 | 0.113 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.994 | 0.994 | 0.994 | 0.994 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.982 | 0.923 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.0933 | 0.171 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.993 | 0.993 | 0.993 | 0.993 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.178 | 0.744 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.0785 | 0.168 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.987 | 0.987 | 0.987 | 0.987 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.97 | 0.923 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.083 | 0.171 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**MAGNESIUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 29 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 29 | 625 | 6085 | 2793 | 2580 | 1352 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 4.255 | 3.838 | 656.4 | 7.813 | 0.526 | 0.0673 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.976 | 0.976 | 0.976 | 0.976 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.949 | 0.926 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.126 | 0.165 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.993 | 0.993 | 0.993 | 0.993 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.191 | 0.75 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.0824 | 0.163 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.984 | 0.984 | 0.984 | 0.984 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.97 | 0.926 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.0974 | 0.165 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**MANGANESE**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 30 | 0 | 30 | 30 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 30 | 232 | 1280 | 706.5 | 707.5 | 276.5 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 6.003 | 5.425 | 117.7 | 6.475 | 0.442 | 0.0683 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.992 | 0.992 | 0.992 | 0.992 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.974 | 0.927 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.088 | 0.162 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.985 | 0.985 | 0.985 | 0.985 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.315 | 0.746 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.139 | 0.16 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.977 | 0.977 | 0.977 | 0.977 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.947 | 0.927 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.165 | 0.162 | Data Not Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**MERCURY**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 29 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 29 | 0.0615 | 0.34 | 0.152 | 0.12 | 0.0836 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 4.005 | 3.614 | 0.038 | -2.012 | 0.504 | -0.251 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.909 | 0.909 | 0.909 | 0.909 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.815 | 0.926 | Data Not Normal |
| Lilliefors (Full: no NDs) | 0.248 | 0.165 | Data Not Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.951 | 0.951 | 0.951 | 0.951 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 1.655 | 0.75 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.199 | 0.163 | Data Not Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.952 | 0.952 | 0.952 | 0.952 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.891 | 0.926 | Data Not Lognormal |
| Lilliefors (Full: no NDs) | 0.171 | 0.165 | Data Not Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**NICKEL**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 28 | 0 | 28 | 28 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 28 | 6.3 | 21.8 | 12.72 | 12 | 4.055 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 10.61 | 9.5 | 1.199 | 2.495 | 0.315 | 0.126 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.973 | 0.973 | 0.973 | 0.973 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.94 | 0.924 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.153 | 0.167 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.987 | 0.987 | 0.987 | 0.987 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.31 | 0.745 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.115 | 0.165 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.992 | 0.992 | 0.992 | 0.992 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.976 | 0.924 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.102 | 0.167 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**POTASSIUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 30 | 0 | 30 | 30 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 30 | 276 | 1710 | 847.8 | 759.5 | 354.1 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 5.945 | 5.372 | 142.6 | 6.656 | 0.433 | 0.0651 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.971 | 0.971 | 0.971 | 0.971 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.939 | 0.927 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.175 | 0.162 | Data Not Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.989 | 0.989 | 0.989 | 0.989 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.373 | 0.746 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.121 | 0.16 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.985 | 0.985 | 0.985 | 0.985 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.968 | 0.927 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.13 | 0.162 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**SELENIUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 30 | 0 | 30 | 1 | 29 | 96.67% |

**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**
**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**

**The data set for variable SELENIUM was not processed!**

**SILVER**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 2 | 27 | 93.10% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Non-Detects Only) | 27 | N/A | N/A | N/A | N/A | N/A |
| Statistics (Detects Only) | 2 | N/A | N/A | N/A | N/A | N/A |
| Statistics (All: NDs treated as DL value) | 29 | N/A | N/A | N/A | N/A | N/A |
| Statistics (All: NDs treated as DL/2 value) | 29 | N/A | N/A | N/A | N/A | N/A |
| Statistics (Normal ROS Estimated Data) | 29 | N/A | N/A | N/A | N/A | N/A |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | N/A | N/A | N/A | N/A |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Detects Only) | N/A | N/A | |
| Lilliefors (Detects Only) | N/A | N/A | |
| Shapiro-Wilks (NDs = DL) | N/A | N/A | |
| Lilliefors (NDs = DL) | N/A | N/A | |
| Shapiro-Wilks (NDs = DL/2) | N/A | N/A | |
| Lilliefors (NDs = DL/2) | N/A | N/A | |
| Shapiro-Wilks (Normal ROS Estimates) | N/A | N/A | |
| Lilliefors (Normal ROS Estimates) | N/A | N/A | |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | N/A | N/A | N/A | N/A |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Detects Only) | N/A | N/A | |
| Kolmogorov-Smirnov (Detects Only) | N/A | N/A | |
| Anderson-Darling (NDs = DL) | N/A | N/A | |
| Kolmogorov-Smirnov (NDs = DL) | N/A | N/A | |
| Anderson-Darling (NDs = DL/2) | N/A | N/A | |
| Kolmogorov-Smirnov (NDs = DL/2) | N/A | N/A | |
| Anderson-Darling (Gamma ROS Estimates) | N/A | N/A | |
| Kolmogorov-Smirnov (Gamma ROS Est.) | N/A | N/A | |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**SODIUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 30 | 0 | 30 | 20 | 10 | 33.33% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Non-Detects Only) | 10 | 92 | 100 | 96.2 | 96 | 3.048 |
| Statistics (Detects Only) | 20 | 98.1 | 271 | 165.2 | 149 | 56.24 |
| Statistics (All: NDs treated as DL value) | 30 | 92 | 271 | 142.2 | 116.5 | 56.29 |
| Statistics (All: NDs treated as DL/2 value) | 30 | 46 | 271 | 126.2 | 116.5 | 72.28 |
| Statistics (Normal ROS Estimated Data) | 30 | 1.117 | 271 | 120.6 | 116.5 | 79.44 |
| Statistics (Gamma ROS Estimated Data) | 30 | 85.76 | 271 | 150.5 | 135.5 | 51.87 |
| Statistics (Lognormal ROS Estimated Data) | 30 | 60.22 | 271 | 134.2 | 116.5 | 63.84 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Detects Only) | 9.773 | 8.818 | 16.9 | 5.055 | 0.327 | 0.0646 |
| Statistics (NDs = DL) | 7.838 | 7.076 | 18.14 | 4.892 | 0.354 | 0.0723 |
| Statistics (NDs = DL/2) | 2.988 | 2.712 | 42.22 | 4.661 | 0.626 | 0.134 |
| Statistics (Gamma ROS Estimates) | 9.989 | 9.012 | 15.07 | -- | -- | -- |
| Statistics (Lognormal ROS Estimates) | -- | -- | -- | 4.795 | 0.463 | 0.0965 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.952 | 0.908 | 0.953 | 0.982 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Detects Only) | 0.89 | 0.905 | Data Not Normal |
| Lilliefors (Detects Only) | 0.152 | 0.198 | Data Appear Normal |
| Shapiro-Wilks (NDs = DL) | 0.81 | 0.927 | Data Not Normal |
| Lilliefors (NDs = DL) | 0.213 | 0.162 | Data Not Normal |
| Shapiro-Wilks (NDs = DL/2) | 0.889 | 0.927 | Data Not Normal |
| Lilliefors (NDs = DL/2) | 0.187 | 0.162 | Data Not Normal |
| Shapiro-Wilks (Normal ROS Estimates) | 0.946 | 0.927 | Data Appear Normal |
| Lilliefors (Normal ROS Estimates) | 0.117 | 0.162 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.971 | 0.951 | 0.97 | 0.968 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Detects Only) | 0.603 | 0.742 | |
| Kolmogorov-Smirnov (Detects Only) | 0.143 | 0.194 | Data Appear Gamma Distributed |
| Anderson-Darling (NDs = DL) | 1.631 | 0.746 | |
| Kolmogorov-Smirnov (NDs = DL) | 0.192 | 0.16 | Data Not Gamma Distributed |
| Anderson-Darling (NDs = DL/2) | 1.121 | 0.753 | |
| Kolmogorov-Smirnov (NDs = DL/2) | 0.215 | 0.161 | Data Not Gamma Distributed |
| Anderson-Darling (Gamma ROS Estimates) | 0.841 | 0.745 | |
| Kolmogorov-Smirnov (Gamma ROS Est.) | 0.144 | 0.16 | Data appear Approximate Gamma Distribution |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.973 | 0.939 | 0.946 | 0.982 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Detects Only) | 0.929 | 0.905 | Data Appear Lognormal |
| Lilliefors (Detects Only) | 0.136 | 0.198 | Data Appear Lognormal |
| Shapiro-Wilks (NDs = DL) | 0.861 | 0.927 | Data Not Lognormal |
| Lilliefors (NDs = DL) | 0.176 | 0.162 | Data Not Lognormal |
| Shapiro-Wilks (NDs = DL/2) | 0.871 | 0.927 | Data Not Lognormal |
| Lilliefors (NDs = DL/2) | 0.218 | 0.162 | Data Not Lognormal |
| Shapiro-Wilks (Lognormal ROS Estimates) | 0.943 | 0.927 | Data Appear Lognormal |
| Lilliefors (Lognormal ROS Estimates) | 0.117 | 0.162 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**THALLIUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 30 | 0 | 30 | 2 | 28 | 93.33% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Non-Detects Only) | 28 | N/A | N/A | N/A | N/A | N/A |
| Statistics (Detects Only) | 2 | N/A | N/A | N/A | N/A | N/A |
| Statistics (All: NDs treated as DL value) | 30 | N/A | N/A | N/A | N/A | N/A |
| Statistics (All: NDs treated as DL/2 value) | 30 | N/A | N/A | N/A | N/A | N/A |
| Statistics (Normal ROS Estimated Data) | 30 | N/A | N/A | N/A | N/A | N/A |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | N/A | N/A | N/A | N/A |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Detects Only) | N/A | N/A | |
| Lilliefors (Detects Only) | N/A | N/A | |
| Shapiro-Wilks (NDs = DL) | N/A | N/A | |
| Lilliefors (NDs = DL) | N/A | N/A | |
| Shapiro-Wilks (NDs = DL/2) | N/A | N/A | |
| Lilliefors (NDs = DL/2) | N/A | N/A | |
| Shapiro-Wilks (Normal ROS Estimates) | N/A | N/A | |
| Lilliefors (Normal ROS Estimates) | N/A | N/A | |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | N/A | N/A | N/A | N/A |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Detects Only) | N/A | N/A | |
| Kolmogorov-Smirnov (Detects Only) | N/A | N/A | |
| Anderson-Darling (NDs = DL) | N/A | N/A | |
| Kolmogorov-Smirnov (NDs = DL) | N/A | N/A | |
| Anderson-Darling (NDs = DL/2) | N/A | N/A | |
| Kolmogorov-Smirnov (NDs = DL/2) | N/A | N/A | |
| Anderson-Darling (Gamma ROS Estimates) | N/A | N/A | |
| Kolmogorov-Smirnov (Gamma ROS Est.) | N/A | N/A | |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**VANADIUM**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 29 | 0 | 29 | 29 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 29 | 46.2 | 147 | 93.37 | 91.1 | 24.61 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 14.37 | 12.91 | 6.497 | 4.501 | 0.276 | 0.0614 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.979 | 0.979 | 0.979 | 0.979 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.955 | 0.926 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.125 | 0.165 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.982 | 0.982 | 0.982 | 0.982 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.432 | 0.745 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.107 | 0.162 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.974 | 0.974 | 0.974 | 0.974 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.947 | 0.926 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.115 | 0.165 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**ZINC**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 27 | 0 | 27 | 27 | 0 | 0.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 27 | 27.6 | 91.1 | 52.96 | 53.5 | 16.17 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Full: no NDs) | 11.16 | 9.946 | 4.745 | 3.924 | 0.311 | 0.0792 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.983 | 0.983 | 0.983 | 0.983 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.96 | 0.923 | Data Appear Normal |
| Lilliefors (Full: no NDs) | 0.134 | 0.171 | Data Appear Normal |

**Gamma Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.992 | 0.992 | 0.992 | 0.992 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Full: no NDs) | 0.229 | 0.744 | |
| Kolmogorov-Smirnov (Full: no NDs) | 0.0963 | 0.168 | Data Appear Gamma Distributed |

**Lognormal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.99 | 0.99 | 0.99 | 0.99 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Full: no NDs) | 0.973 | 0.923 | Data Appear Lognormal |
| Lilliefors (Full: no NDs) | 0.115 | 0.171 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

# Attachment 4

Rosner Outlier Tests - Metals

## Outlier Tests for Selected Variables

**User Selected Options**

| | |
|---|---|
| From File | Z:\Projects\Fort Buchanan\Response to Comments (Background)\inp_BUCH_SOIL_DATA_0211.wst |
| Full Precision | OFF |
| Test for Suspected Outliers with Dixon test | 1 |
| Test for Suspected Outliers for Rosner test | 1 |

### Rosner's Outlier Test for ALUMINUM

| | |
|---|---|
| **Mean** | **23063** |
| **Standard Deviation** | **4031** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **1** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 23063 | 3964 | 34000 | 30 | 2.759 | 2.91 | 3.24 |

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

### Rosner's Outlier Test for ARSENIC

| | |
|---|---|
| **Mean** | **16.33** |
| **Standard Deviation** | **10.18** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **1** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 16.33 | 10.01 | 47.1 | 30 | 3.074 | 2.91 | 3.24 |

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation 47.1 is a Potential Statistical Outlier

For 1% Significance Level, there is no Potential Outlier

**Rosner's Outlier Test for BARIUM**

| | |
|---|---|
| **Mean** | **61.76** |
| **Standard Deviation** | **23.2** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **1** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 61.76 | 22.81 | 118 | 30 | 2.466 | 2.91 | 3.24 |

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

**Rosner's Outlier Test for CADMIUM**

| | |
|---|---|
| **Mean** | **0.527** |
| **Standard Deviation** | **0.54** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **1** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 0.527 | 0.531 | 3.05 | 30 | 4.755 | 2.91 | 3.24 |

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation 3.05 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation 3.05 is a Potential Statistical Outlier

**Rosner's Outlier Test for CHROMIUM**

| | |
|---|---|
| **Mean** | **43.83** |
| **Standard Deviation** | **15.04** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **2** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 43.83 | 14.78 | 89.7 | 30 | 3.103 | 2.91 | 3.24 |
| 2 | 42.25 | 12.51 | 78 | 29 | 2.859 | 2.89 | 3.22 |

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation 89.7 is a Potential Statistical Outlier

For 1% Significance Level, there is no Potential Outlier

**Rosner's Outlier Test for COBALT**

| | |
|---|---|
| **Mean** | **11.09** |
| **Standard Deviation** | **4.698** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **1** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 11.09 | 4.619 | 28 | 30 | 3.662 | 2.91 | 3.24 |

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation 28 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation 28 is a Potential Statistical Outlier

**Rosner's Outlier Test for IRON**

| | |
|---|---|
| **Mean** | **30169** |
| **Standard Deviation** | **9781** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **1** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 30169 | 9617 | 54300 | 30 | 2.509 | 2.91 | 3.24 |

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

**Rosner's Outlier Test for LEAD**

| | |
|---|---|
| **Mean** | **27.49** |
| **Standard Deviation** | **30.73** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **3** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 27.49 | 30.22 | 152 | 30 | 4.12 | 2.91 | 3.24 |
| 2 | 23.19 | 20.14 | 103 | 29 | 3.963 | 2.89 | 3.22 |
| 3 | 20.34 | 13.28 | 82.35 | 28 | 4.67 | 2.88 | 3.2 |

For 5% significance level, there are 3 Potential Outliers

Therefore, Potential Statistical Outliers are

152, 103, 82.35

For 1% Significance Level, there are 3 Potential Outliers

Therefore, Potential Statistical Outliers are

152, 103, 82.35

**Rosner's Outlier Test for MAGNESIUM**

| | |
|---|---|
| **Mean** | **2997** |
| **Standard Deviation** | **1736** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **1** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 2997 | 1707 | 8920 | 30 | 3.469 | 2.91 | 3.24 |

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation 8920 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation 8920 is a Potential Statistical Outlier

**Rosner's Outlier Test for MANGANESE**

| | |
|---|---|
| **Mean** | **706.5** |
| **Standard Deviation** | **276.5** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **1** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 706.5 | 271.8 | 1280 | 30 | 2.11 | 2.91 | 3.24 |

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

**Rosner's Outlier Test for NICKEL**

| | |
|---|---|
| **Mean** | **14.28** |
| **Standard Deviation** | **7.29** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **2** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 14.28 | 7.167 | 42.3 | 30 | 3.909 | 2.91 | 3.24 |
| 2 | 13.31 | 5.102 | 29.9 | 29 | 3.251 | 2.89 | 3.22 |

For 5% significance level, there are 2 Potential Outliers

Therefore, Potential Statistical Outliers are

42.3, 29.9

For 1% Significance Level, there are 2 Potential Outliers

Therefore, Potential Statistical Outliers are

42.3, 29.9

**Rosner's Outlier Test for VANADIUM**

| | |
|---|---|
| **Mean** | **96.13** |
| **Standard Deviation** | **28.5** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **1** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 96.13 | 28.02 | 176 | 30 | 2.85 | 2.91 | 3.24 |

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

**Rosner's Outlier Test for ZINC**

| | |
|---|---|
| **Mean** | **84.23** |
| **Standard Deviation** | **111** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **3** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | 84.23 | 109.1 | 603 | 30 | 4.755 | 2.91 | 3.24 |
| 2 | 66.34 | 53.02 | 277 | 29 | 3.973 | 2.89 | 3.22 |
| 3 | 58.82 | 34.82 | 217 | 28 | 4.542 | 2.88 | 3.2 |

For 5% significance level, there are 3 Potential Outliers

Therefore, Potential Statistical Outliers are

603, 277, 217

For 1% Significance Level, there are 3 Potential Outliers

Therefore, Potential Statistical Outliers are

603, 277, 217

# Rosner Outlier Test Log-Normal Distribution

## Outlier Tests for Selected Variables

**User Selected Options**

| | |
|---|---|
| From File | Z:\Projects\Fort Buchanan\Response to Comments (Background)\inp_BUCH_Log_DATA_( |
| Full Precision | OFF |
| Test for Suspected Outliers with Dixon test | 1 |
| Test for Suspected Outliers for Rosner test | 1 |

### Rosner's Outlier Test for BERYLLIUM

| | |
|---|---|
| **Mean** | **-1.095** |
| **Standard Deviation** | **0.449** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **2** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | -1.095 | 0.442 | -1.97 | 1 | 1.98 | 2.91 | 3.24 |
| 2 | -1.064 | 0.425 | -0.261 | 30 | 1.888 | 2.89 | 3.22 |

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

### Rosner's Outlier Test for MERCURY

| | |
|---|---|
| **Mean** | **-1.942** |
| **Standard Deviation** | **0.627** |
| **Number of data** | **30** |
| **Number of suspected outliers** | **1** |

| # | Mean | sd | Potential outlier | Obs. Number | Test value | Critical value (5%) | Critical value (1%) |
|---|---|---|---|---|---|---|---|
| 1 | -1.942 | 0.617 | 0.0953 | 30 | 3.302 | 2.91 | 3.24 |

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation 0.0953 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation 0.0953 is a Potential Statistical Outlier

# Attachment 5

ProUCL Output, Dataset Excluding Outliers - Metals

## General Background Statistics for Data Sets with Non-Detects

**User Selected Options**

| | |
|---|---|
| From File | Z:\Projects\Fort Buchanan\Response to Comments (Background)\inp_BUCH_Normal_DATA_0211.wst |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Coverage | 90% |
| Different or Future K Values | 1 |
| Number of Bootstrap Operations | 10000 |

**ALUMINUM**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 30 | Number of Distinct Observations | 27 |

**Raw Statistics**

| | |
|---|---|
| Minimum | 14700 |
| Maximum | 34000 |
| Second Largest | 28700 |
| First Quartile | 21188 |
| Median | 22750 |
| Third Quartile | 26075 |
| Mean | 23063 |
| SD | 4031 |
| Coefficient of Variation | 0.175 |
| Skewness | 0.22 |

**Log-Transformed Statistics**

| | |
|---|---|
| Minimum | 9.596 |
| Maximum | 10.43 |
| Second Largest | 10.26 |
| First Quartile | 9.961 |
| Median | 10.03 |
| Third Quartile | 10.17 |
| Mean | 10.03 |
| SD | 0.18 |

**Background Statistics**

**Normal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.963 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 30227 |
| 95% UPL (t) | 30027 |
| 90% Percentile (z) | 28230 |
| 95% Percentile (z) | 29694 |
| 99% Percentile (z) | 32442 |

**Gamma Distribution Test**

| | |
|---|---|
| k star | 29.77 |
| Theta Star | 774.8 |
| MLE of Mean | 23063 |
| MLE of Standard Deviation | 4227 |
| nu star | 1786 |
| A-D Test Statistic | 0.568 |
| 5% A-D Critical Value | 0.744 |
| K-S Test Statistic | 0.148 |
| 5% K-S Critical Value | 0.16 |

Data appear Gamma Distributed at 5% Significance Level

**Assuming Gamma Distribution**

| | |
|---|---|
| 90% Percentile | 28619 |
| 95% Percentile | 30428 |
| 99% Percentile | 34019 |
| 95% WH Approx. Gamma UPL | 30571 |
| 95% HW Approx. Gamma UPL | 30662 |

**Lognormal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.953 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Lognormal at 5% Significance Level

**Assuming Lognormal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 31252 |
| 95% UPL (t) | 30974 |
| 90% Percentile (z) | 28592 |
| 95% Percentile (z) | 30519 |
| 99% Percentile (z) | 34492 |

**Data Distribution Test**

Data appear Normal at 5% Significance Level

**Nonparametric Statistics**

| | |
|---|---|
| 90% Percentile | 27940 |
| 95% Percentile | 31085 |
| 99% Percentile | 34000 |
| 95% UTL with 90% Coverage | 28700 |
| 95% Percentile Bootstrap UTL with 90% Coverage | 28700 |
| 95% BCA Bootstrap UTL with 90% Coverage | 28700 |
| 95% UPL | 31085 |
| 95% Chebyshev UPL | 40926 |
| Upper Threshold Limit Based upon IQR | 33406 |

| | | |
|---|---|---|
| 95% WH Approx. Gamma UTL with | 90% Coverage | 30817 |
| 95% HW Approx. Gamma UTL with | 90% Coverage | 30915 |

Note: UPL represents a preferred estimate of BTV

**ANTIMONY**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 29 | Number of Detected Data | 0 |
| Number of Distinct Detected Data | 0 | Number of Non-Detect Data | 29 |

**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**
**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**
**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**

**The data set for variable ANTIMONY was not processed!**

ARSENIC

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 30 | Number of Distinct Observations | 30 |

**Raw Statistics**

| | |
|---|---|
| Minimum | 3 |
| Maximum | 47.1 |
| Second Largest | 33.5 |
| First Quartile | 9.088 |
| Median | 15 |
| Third Quartile | 20.05 |
| Mean | 16.33 |
| SD | 10.18 |
| Coefficient of Variation | 0.624 |
| Skewness | 1.126 |

**Log-Transformed Statistics**

| | |
|---|---|
| Minimum | 1.099 |
| Maximum | 3.852 |
| Second Largest | 3.512 |
| First Quartile | 2.207 |
| Median | 2.708 |
| Third Quartile | 2.998 |
| Mean | 2.588 |
| SD | 0.691 |

**Background Statistics**

**Normal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.913 |
| Shapiro Wilk Critical Value | 0.927 |

Data not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 34.42 |
| 95% UPL (t) | 33.91 |
| 90% Percentile (z) | 29.38 |
| 95% Percentile (z) | 33.07 |
| 99% Percentile (z) | 40.01 |

**Gamma Distribution Test**

| | |
|---|---|
| k star | 2.362 |
| Theta Star | 6.912 |
| MLE of Mean | 16.33 |
| MLE of Standard Deviation | 10.62 |
| nu star | 141.7 |
| A-D Test Statistic | 0.366 |
| 5% A-D Critical Value | 0.755 |
| K-S Test Statistic | 0.092 |
| 5% K-S Critical Value | 0.162 |

Data appear Gamma Distributed at 5% Significance Level

**Assuming Gamma Distribution**

| | |
|---|---|
| 90% Percentile | 30.55 |
| 95% Percentile | 36.78 |
| 99% Percentile | 50.45 |
| 95% WH Approx. Gamma UPL | 37.54 |
| 95% HW Approx. Gamma UPL | 38.62 |
| 95% WH Approx. Gamma UTL with 90% Coverage | 38.44 |
| 95% HW Approx. Gamma UTL with 90% Coverage | 39.63 |

**Lognormal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.951 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Lognormal at 5% Significance Level

**Assuming Lognormal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 45.41 |
| 95% UPL (t) | 43.87 |
| 90% Percentile (z) | 32.25 |
| 95% Percentile (z) | 41.45 |
| 99% Percentile (z) | 66.36 |

**Data Distribution Test**

Data appear Gamma Distributed at 5% Significance Level

**Nonparametric Statistics**

| | |
|---|---|
| 90% Percentile | 32.93 |
| 95% Percentile | 39.62 |
| 99% Percentile | 47.1 |
| 95% UTL with 90% Coverage | 33.5 |
| 95% Percentile Bootstrap UTL with 90% Coverage | 33.5 |
| 95% BCA Bootstrap UTL with 90% Coverage | 33.5 |
| 95% UPL | 39.62 |
| 95% Chebyshev UPL | 61.44 |
| Upper Threshold Limit Based upon IQR | 36.49 |

Note: UPL represents a preferred estimate of BTV

**BARIUM**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 30 | Number of Distinct Observations | 30 |

**Raw Statistics**

| | |
|---|---|
| Minimum | 25.8 |
| Maximum | 118 |
| Second Largest | 99.1 |
| First Quartile | 40.74 |
| Median | 63.4 |
| Third Quartile | 77.63 |
| Mean | 61.76 |
| SD | 23.2 |
| Coefficient of Variation | 0.376 |
| Skewness | 0.348 |

**Log-Transformed Statistics**

| | |
|---|---|
| Minimum | 3.25 |
| Maximum | 4.771 |
| Second Largest | 4.596 |
| First Quartile | 3.707 |
| Median | 4.149 |
| Third Quartile | 4.352 |
| Mean | 4.049 |
| SD | 0.402 |

**Background Statistics**

**Normal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.96 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Normal at 5% Significance Level

**Lognormal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.953 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Lognormal at 5% Significance Level

**Assuming Normal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 103 |
| 95% UPL (t) | 101.8 |
| 90% Percentile (z) | 91.49 |
| 95% Percentile (z) | 99.92 |
| 99% Percentile (z) | 115.7 |

**Assuming Lognormal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 117.1 |
| 95% UPL (t) | 114.8 |
| 90% Percentile (z) | 95.98 |
| 95% Percentile (z) | 111.1 |
| 99% Percentile (z) | 146 |

**Gamma Distribution Test**

| | |
|---|---|
| k star | 6.269 |
| Theta Star | 9.851 |
| MLE of Mean | 61.76 |
| MLE of Standard Deviation | 24.66 |
| nu star | 376.1 |
| A-D Test Statistic | 0.474 |
| 5% A-D Critical Value | 0.746 |
| K-S Test Statistic | 0.131 |
| 5% K-S Critical Value | 0.16 |

Data appear Gamma Distributed at 5% Significance Level

**Data Distribution Test**

Data appear Normal at 5% Significance Level

**Nonparametric Statistics**

| | |
|---|---|
| 90% Percentile | 95.83 |
| 95% Percentile | 107.6 |
| 99% Percentile | 118 |
| 95% UTL with 90% Coverage | 99.1 |
| 95% Percentile Bootstrap UTL with 90% Coverage | 99.1 |
| 95% BCA Bootstrap UTL with 90% Coverage | 99.1 |
| 95% UPL | 107.6 |
| 95% Chebyshev UPL | 164.6 |
| Upper Threshold Limit Based upon IQR | 133 |

**Assuming Gamma Distribution**

| | |
|---|---|
| 90% Percentile | 94.72 |
| 95% Percentile | 107.1 |
| 99% Percentile | 133 |
| 95% WH Approx. Gamma UPL | 108.4 |
| 95% HW Approx. Gamma UPL | 109.8 |
| 95% WH Approx. Gamma UTL with 90% Coverage | 110.2 |
| 95% HW Approx. Gamma UTL with 90% Coverage | 111.6 |

Note: UPL represents a preferred estimate of BTV

**BERYLLIUM**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 30 | Number of Distinct Observations | 23 |

| Raw Statistics | | Log-Transformed Statistics | |
|---|---|---|---|
| Minimum | 0.14 | Minimum | -1.97 |
| Maximum | 0.77 | Maximum | -0.261 |
| Second Largest | 0.71 | Second Largest | -0.342 |
| First Quartile | 0.23 | First Quartile | -1.47 |
| Median | 0.335 | Median | -1.094 |
| Third Quartile | 0.505 | Third Quartile | -0.683 |
| Mean | 0.368 | Mean | -1.095 |
| SD | 0.162 | SD | 0.449 |
| Coefficient of Variation | 0.439 | | |
| Skewness | 0.684 | | |

**Background Statistics**

| Normal Distribution Test | | Lognormal Distribution Test | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.936 | Shapiro Wilk Test Statistic | 0.968 |
| Shapiro Wilk Critical Value | 0.927 | Shapiro Wilk Critical Value | 0.927 |
| Data appear Normal at 5% Significance Level | | Data appear Lognormal at 5% Significance Level | |
| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
| 95% UTL with 90% Coverage | 0.655 | 95% UTL with 90% Coverage | 0.744 |
| 95% UPL (t) | 0.647 | 95% UPL (t) | 0.727 |
| 90% Percentile (z) | 0.575 | 90% Percentile (z) | 0.595 |
| 95% Percentile (z) | 0.634 | 95% Percentile (z) | 0.701 |
| 99% Percentile (z) | 0.744 | 99% Percentile (z) | 0.952 |
| **Gamma Distribution Test** | | **Data Distribution Test** | |
| k star | 4.908 | Data appear Normal at 5% Significance Level | |
| Theta Star | 0.075 | | |
| MLE of Mean | 0.368 | | |
| MLE of Standard Deviation | 0.166 | | |
| nu star | 294.5 | | |
| A-D Test Statistic | 0.353 | **Nonparametric Statistics** | |
| 5% A-D Critical Value | 0.746 | 90% Percentile | 0.548 |
| K-S Test Statistic | 0.101 | 95% Percentile | 0.737 |
| 5% K-S Critical Value | 0.16 | 99% Percentile | 0.77 |
| Data appear Gamma Distributed at 5% Significance Level | | | |
| **Assuming Gamma Distribution** | | 95% UTL with 90% Coverage | 0.71 |
| 90% Percentile | 0.59 | 95% Percentile Bootstrap UTL with 90% Coverage | 0.71 |
| 95% Percentile | 0.677 | 95% BCA Bootstrap UTL with 90% Coverage | 0.71 |
| 99% Percentile | 0.86 | 95% UPL | 0.737 |
| | | 95% Chebyshev UPL | 1.084 |
| 95% WH Approx. Gamma UPL | 0.686 | Upper Threshold Limit Based upon IQR | 0.918 |
| 95% HW Approx. Gamma UPL | 0.695 | | |
| 95% WH Approx. Gamma UTL with 90% Coverage | 0.698 | | |
| 95% HW Approx. Gamma UTL with 90% Coverage | 0.708 | | |

Note: UPL represents a preferred estimate of BTV

**CADMIUM**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 29 | Number of Detected Data | 24 |
| Number of Distinct Detected Data | 22 | Number of Non-Detect Data | 5 |
| | | Percent Non-Detects | 17.24% |

**Raw Statistics**

| | |
|---|---|
| Minimum Detected | 0.19 |
| Maximum Detected | 0.9 |
| Mean of Detected | 0.512 |
| SD of Detected | 0.222 |
| Minimum Non-Detect | 0.17 |
| Maximum Non-Detect | 0.2 |

**Log-transformed Statistics**

| | |
|---|---|
| Minimum Detected | -1.661 |
| Maximum Detected | -0.105 |
| Mean of Detected | -0.769 |
| SD of Detected | 0.47 |
| Minimum Non-Detect | -1.772 |
| Maximum Non-Detect | -1.609 |

**Data with Multiple Detection Limits**

Note: Data have multiple DLs - Use of KM Method is recommended

For all methods (except KM, DL/2, and ROS Methods),

Observations < Largest ND are treated as NDs

**Single Detection Limit Scenario**

| | |
|---|---|
| Number treated as Non-Detect with Single DL | 6 |
| Number treated as Detected with Single DL | 23 |
| Single DL Non-Detect Percentage | 20.69% |

**Background Statistics**

**Normal Distribution Test with Detected Values Only**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.93 |
| 5% Shapiro Wilk Critical Value | 0.916 |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

DL/2 Substitution Method

| | |
|---|---|
| Mean | 0.44 |
| SD | 0.258 |
| 95% UTL 90% Coverage | 0.901 |
| 95% UPL (t) | 0.886 |
| 90% Percentile (z) | 0.77 |
| 95% Percentile (z) | 0.864 |
| 99% Percentile (z) | 1.039 |

Maximum Likelihood Estimate(MLE) Method

| | |
|---|---|
| Mean | 0.426 |
| SD | 0.277 |
| 95% UTL with 90% Coverage | 0.922 |
| 95% UPL (t) | 0.906 |
| 90% Percentile (z) | 0.782 |
| 95% Percentile (z) | 0.883 |
| 99% Percentile (z) | 1.072 |

**Lognormal Distribution Test with Detected Values Only**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.928 |
| 5% Shapiro Wilk Critical Value | 0.916 |

Data appear Lognormal at 5% Significance Level

**Assuming Lognormal Distribution**

DL/2 Substitution Method

| | |
|---|---|
| Mean (Log Scale) | -1.048 |
| SD (Log Scale) | 0.755 |
| 95% UTL 90% Coverage | 1.352 |
| 95% UPL (t) | 1.294 |
| 90% Percentile (z) | 0.922 |
| 95% Percentile (z) | 1.213 |
| 99% Percentile (z) | 2.029 |

Log ROS Method

| | |
|---|---|
| Mean in Original Scale | 0.453 |
| SD in Original Scale | 0.241 |
| 95% UTL with 90% Coverage | 1.101 |
| 95% BCA UTL with 90% Coverage | 0.864 |
| 95% Bootstrap (%) UTL with 90% Coverage | 0.864 |
| 95% UPL (t) | 1.064 |
| 90% Percentile (z) | 0.819 |
| 95% Percentile (z) | 1.013 |
| 99% Percentile (z) | 1.507 |

**Gamma Distribution Test with Detected Values Only**

| | |
|---|---|
| k star (bias corrected) | 4.559 |
| Theta Star | 0.112 |
| nu star | 218.8 |

**Data Distribution Test with Detected Values Only**

Data appear Normal at 5% Significance Level

**CADMIUM continued**

| | |
|---|---|
| A-D Test Statistic | 0.641 |
| 5% A-D Critical Value | 0.746 |
| K-S Test Statistic | 0.175 |
| 5% K-S Critical Value | 0.178 |

Data appear Gamma Distributed at 5% Significance Level

**Assuming Gamma Distribution**

Gamma ROS Statistics with Extrapolated Data

| | |
|---|---|
| Mean | 0.455 |
| Median | 0.42 |
| SD | 0.238 |
| k star | 3.178 |
| Theta star | 0.143 |
| Nu star | 184.3 |
| 95% Percentile of Chisquare (2k) | 13.12 |
| 90% Percentile | 0.798 |
| 95% Percentile | 0.94 |
| 99% Percentile | 1.247 |

**Nonparametric Statistics**

Kaplan-Meier (KM) Method

| | |
|---|---|
| Mean | 0.457 |
| SD | 0.232 |
| SE of Mean | 0.044 |
| 95% KM UTL with 90% Coverage | 0.871 |
| 95% KM Chebyshev UPL | 1.484 |
| 95% KM UPL (t) | 0.858 |
| 90% Percentile (z) | 0.754 |
| 95% Percentile (z) | 0.838 |
| 99% Percentile (z) | 0.996 |

**Gamma ROS Limits with Extrapolated Data**

| | |
|---|---|
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | 0.959 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | 0.979 |
| 95% WH Approx. Gamma UTL with 90% Coverage | 0.982 |
| 95% HW Approx. Gamma UTL with 90% Coverage | 1.005 |

Note: UPL represents a preferred estimate of BTV

For an Example: KM-UPL may be used when multiple detection limits are present

Note: DL/2 is not a recommended method.

CALCIUM

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 30 | Number of Distinct Observations | 30 |

**Raw Statistics**

| | |
|---|---|
| Minimum | 3130 |
| Maximum | 117000 |
| Second Largest | 80300 |
| First Quartile | 6120 |
| Median | 13550 |
| Third Quartile | 44200 |
| Mean | 27905 |
| SD | 29424 |
| Coefficient of Variation | 1.054 |
| Skewness | 1.42 |

**Log-Transformed Statistics**

| | |
|---|---|
| Minimum | 8.049 |
| Maximum | 11.67 |
| Second Largest | 11.29 |
| First Quartile | 8.719 |
| Median | 9.507 |
| Third Quartile | 10.69 |
| Mean | 9.686 |
| SD | 1.09 |

**Background Statistics**

**Normal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.801 |
| Shapiro Wilk Critical Value | 0.927 |

Data not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 80191 |
| 95% UPL (t) | 78726 |
| 90% Percentile (z) | 65613 |
| 95% Percentile (z) | 76302 |
| 99% Percentile (z) | 96354 |

**Gamma Distribution Test**

| | |
|---|---|
| k star | 0.962 |
| Theta Star | 29018 |
| MLE of Mean | 27905 |
| MLE of Standard Deviation | 28456 |
| nu star | 57.7 |
| A-D Test Statistic | 0.989 |
| 5% A-D Critical Value | 0.774 |
| K-S Test Statistic | 0.181 |
| 5% K-S Critical Value | 0.165 |

Data not Gamma Distributed at 5% Significance Level

**Assuming Gamma Distribution**

| | |
|---|---|
| 90% Percentile | 64874 |
| 95% Percentile | 84761 |
| 99% Percentile | 131068 |
| 95% WH Approx. Gamma UPL | 86404 |
| 95% HW Approx. Gamma UPL | 89351 |
| 95% WH Approx. Gamma UTL with 90% Coverage | 89357 |
| 95% HW Approx. Gamma UTL with 90% Coverage | 92740 |

**Lognormal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.931 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Lognormal at 5% Significance Level

**Assuming Lognormal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 111753 |
| 95% UPL (t) | 105848 |
| 90% Percentile (z) | 65107 |
| 95% Percentile (z) | 96756 |
| 99% Percentile (z) | 203432 |

**Data Distribution Test**

Data appear Lognormal at 5% Significance Level

**Nonparametric Statistics**

| | |
|---|---|
| 90% Percentile | 74645 |
| 95% Percentile | 96815 |
| 99% Percentile | 117000 |
| 95% UTL with 90% Coverage | 80300 |
| 95% Percentile Bootstrap UTL with 90% Coverage | 80300 |
| 95% BCA Bootstrap UTL with 90% Coverage | 80300 |
| 95% UPL | 96815 |
| 95% Chebyshev UPL | 158280 |
| Upper Threshold Limit Based upon IQR | 101320 |

Note: UPL represents a preferred estimate of BTV

**CHROMIUM**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 30 | Number of Distinct Observations | 29 |

| Raw Statistics | | Log-Transformed Statistics | |
|---|---|---|---|
| Minimum | 17.5 | Minimum | 2.862 |
| Maximum | 89.7 | Maximum | 4.496 |
| Second Largest | 78 | Second Largest | 4.357 |
| First Quartile | 33.79 | First Quartile | 3.52 |
| Median | 41.9 | Median | 3.735 |
| Third Quartile | 51.8 | Third Quartile | 3.947 |
| Mean | 43.83 | Mean | 3.727 |
| SD | 15.04 | SD | 0.334 |
| Coefficient of Variation | 0.343 | | |
| Skewness | 1.168 | | |

**Background Statistics**

| Normal Distribution Test | | Lognormal Distribution Test | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.928 | Shapiro Wilk Test Statistic | 0.986 |
| Shapiro Wilk Critical Value | 0.927 | Shapiro Wilk Critical Value | 0.927 |
| Data appear Normal at 5% Significance Level | | Data appear Lognormal at 5% Significance Level | |

| Assuming Normal Distribution | | Assuming Lognormal Distribution | |
|---|---|---|---|
| 95% UTL with 90% Coverage | 70.55 | 95% UTL with 90% Coverage | 75.19 |
| 95% UPL (t) | 69.8 | 95% UPL (t) | 73.95 |
| 90% Percentile (z) | 63.1 | 90% Percentile (z) | 63.73 |
| 95% Percentile (z) | 68.56 | 95% Percentile (z) | 71.95 |
| 99% Percentile (z) | 78.81 | 99% Percentile (z) | 90.33 |

| Gamma Distribution Test | | Data Distribution Test |
|---|---|---|
| k star | 8.56 | Data appear Normal at 5% Significance Level |
| Theta Star | 5.12 | |
| MLE of Mean | 43.83 | |
| MLE of Standard Deviation | 14.98 | |
| nu star | 513.6 | |
| A-D Test Statistic | 0.232 | |
| 5% A-D Critical Value | 0.746 | |
| K-S Test Statistic | 0.0689 | |
| 5% K-S Critical Value | 0.16 | |
| Data appear Gamma Distributed at 5% Significance Level | | |

| Nonparametric Statistics | |
|---|---|
| 90% Percentile | 60.21 |
| 95% Percentile | 83.27 |
| 99% Percentile | 89.7 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 90% Percentile | 63.79 | 95% UTL with 90% Coverage | 78 |
| 95% Percentile | 71.02 | 95% Percentile Bootstrap UTL with 90% Coverage | 78 |
| 99% Percentile | 85.96 | 95% BCA Bootstrap UTL with 90% Coverage | 78 |
| | | 95% UPL | 83.27 |
| | | 95% Chebyshev UPL | 110.5 |
| 95% WH Approx. Gamma UPL | 71.67 | Upper Threshold Limit Based upon IQR | 78.82 |
| 95% HW Approx. Gamma UPL | 72.13 | | |
| 95% WH Approx. Gamma UTL with 90% Coverage | 72.68 | | |
| 95% HW Approx. Gamma UTL with 90% Coverage | 73.18 | | |

Note: UPL represents a preferred estimate of BTV

COBALT

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 26 |

| Raw Statistics | | Log-Transformed Statistics | |
|---|---|---|---|
| Minimum | 4 | Minimum | 1.386 |
| Maximum | 15.8 | Maximum | 2.76 |
| Second Largest | 14.75 | Second Largest | 2.691 |
| First Quartile | 7.05 | First Quartile | 1.953 |
| Median | 11.1 | Median | 2.407 |
| Third Quartile | 13.6 | Third Quartile | 2.61 |
| Mean | 10.5 | Mean | 2.287 |
| SD | 3.505 | SD | 0.385 |
| Coefficient of Variation | 0.334 | | |
| Skewness | -0.308 | | |

**Background Statistics**

| Normal Distribution Test | | Lognormal Distribution Test | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.931 | Shapiro Wilk Test Statistic | 0.902 |
| Shapiro Wilk Critical Value | 0.926 | Shapiro Wilk Critical Value | 0.926 |
| Data appear Normal at 5% Significance Level | | Data not Lognormal at 5% Significance Level | |

| Assuming Normal Distribution | | Assuming Lognormal Distribution | |
|---|---|---|---|
| 95% UTL with 90% Coverage | 16.77 | 95% UTL with 90% Coverage | 19.58 |
| 95% UPL (t) | 16.57 | 95% UPL (t) | 19.15 |
| 90% Percentile (z) | 14.99 | 90% Percentile (z) | 16.12 |
| 95% Percentile (z) | 16.27 | 95% Percentile (z) | 18.53 |
| 99% Percentile (z) | 18.66 | 99% Percentile (z) | 24.08 |

| Gamma Distribution Test | | Data Distribution Test |
|---|---|---|
| k star | 7.11 | Data appear Normal at 5% Significance Level |
| Theta Star | 1.477 | |
| MLE of Mean | 10.5 | |
| MLE of Standard Deviation | 3.939 | |
| nu star | 412.4 | |
| A-D Test Statistic | 0.897 | |
| 5% A-D Critical Value | 0.746 | |
| K-S Test Statistic | 0.149 | |
| 5% K-S Critical Value | 0.163 | |
| Data follow Appx. Gamma Distribution at 5% Significance Level | | |

| Nonparametric Statistics | |
|---|---|
| 90% Percentile | 14.7 |
| 95% Percentile | 15.28 |
| 99% Percentile | 15.8 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 90% Percentile | 15.76 | 95% UTL with 90% Coverage | 14.75 |
| 95% Percentile | 17.71 | 95% Percentile Bootstrap UTL with 90% Coverage | 14.86 |
| 99% Percentile | 21.76 | 95% BCA Bootstrap UTL with 90% Coverage | 14.86 |
| | | 95% UPL | 15.28 |
| | | 95% Chebyshev UPL | 26.04 |
| 95% WH Approx. Gamma UPL | 17.93 | Upper Threshold Limit Based upon IQR | 23.43 |
| 95% HW Approx. Gamma UPL | 18.18 | | |
| 95% WH Approx. Gamma UTL with 90% Coverage | 18.24 | | |
| 95% HW Approx. Gamma UTL with 90% Coverage | 18.52 | | |

Note: UPL represents a preferred estimate of BTV

COPPER

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 30 | Number of Distinct Observations | 29 |

| Raw Statistics | | Log-Transformed Statistics | |
|---|---|---|---|
| Minimum | 14.9 | Minimum | 2.701 |
| Maximum | 111 | Maximum | 4.71 |
| Second Largest | 88 | Second Largest | 4.477 |
| First Quartile | 29.88 | First Quartile | 3.397 |
| Median | 39.75 | Median | 3.683 |
| Third Quartile | 45.6 | Third Quartile | 3.817 |
| Mean | 43 | Mean | 3.663 |
| SD | 20.98 | SD | 0.442 |
| Coefficient of Variation | 0.488 | | |
| Skewness | 1.614 | | |

**Background Statistics**

| Normal Distribution Test | | Lognormal Distribution Test | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.858 | Shapiro Wilk Test Statistic | 0.977 |
| Shapiro Wilk Critical Value | 0.927 | Shapiro Wilk Critical Value | 0.927 |
| Data not Normal at 5% Significance Level | | Data appear Lognormal at 5% Significance Level | |
| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
| 95% UTL with 90% Coverage | 80.28 | 95% UTL with 90% Coverage | 85.51 |
| 95% UPL (t) | 79.23 | 95% UPL (t) | 83.65 |
| 90% Percentile (z) | 69.88 | 90% Percentile (z) | 68.69 |
| 95% Percentile (z) | 77.51 | 95% Percentile (z) | 80.66 |
| 99% Percentile (z) | 91.8 | 99% Percentile (z) | 109 |
| **Gamma Distribution Test** | | **Data Distribution Test** | |
| k star | 4.761 | Data Follow Appr. Gamma Distribution at 5% Significance Level | |
| Theta Star | 9.03 | | |
| MLE of Mean | 43 | | |
| MLE of Standard Deviation | 19.7 | | |
| nu star | 285.7 | | |
| A-D Test Statistic | 0.575 | **Nonparametric Statistics** | |
| 5% A-D Critical Value | 0.746 | 90% Percentile | 78.16 |
| K-S Test Statistic | 0.196 | 95% Percentile | 98.35 |
| 5% K-S Critical Value | 0.16 | 99% Percentile | 111 |

Data follow Appx. Gamma Distribution at 5% Significance Level

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 90% Percentile | 69.38 | 95% UTL with 90% Coverage | 88 |
| 95% Percentile | 79.68 | 95% Percentile Bootstrap UTL with 90% Coverage | 88 |
| 99% Percentile | 101.5 | 95% BCA Bootstrap UTL with 90% Coverage | 88 |
| | | 95% UPL | 98.35 |
| | | 95% Chebyshev UPL | 136 |
| 95% WH Approx. Gamma UPL | 80.63 | Upper Threshold Limit Based upon IQR | 69.19 |
| 95% HW Approx. Gamma UPL | 81.18 | | |
| 95% WH Approx. Gamma UTL with 90% Coverage | 82.08 | | |
| 95% HW Approx. Gamma UTL with 90% Coverage | 82.71 | | |

Note: UPL represents a preferred estimate of BTV

IRON

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 30 | Number of Distinct Observations | 28 |

| Raw Statistics | | Log-Transformed Statistics | |
|---|---|---|---|
| Minimum | 8350 | Minimum | 9.03 |
| Maximum | 54300 | Maximum | 10.9 |
| Second Largest | 43200 | Second Largest | 10.67 |
| First Quartile | 25575 | First Quartile | 10.15 |
| Median | 31100 | Median | 10.34 |
| Third Quartile | 34700 | Third Quartile | 10.45 |
| Mean | 30169 | Mean | 10.25 |
| SD | 9781 | SD | 0.416 |
| Coefficient of Variation | 0.324 | | |
| Skewness | -0.229 | | |

**Background Statistics**

| Normal Distribution Test | | Lognormal Distribution Test | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.947 | Shapiro Wilk Test Statistic | 0.822 |
| Shapiro Wilk Critical Value | 0.927 | Shapiro Wilk Critical Value | 0.927 |
| Data appear Normal at 5% Significance Level | | Data not Lognormal at 5% Significance Level | |

| Assuming Normal Distribution | | Assuming Lognormal Distribution | |
|---|---|---|---|
| 95% UTL with 90% Coverage | 47551 | 95% UTL with 90% Coverage | 58978 |
| 95% UPL (t) | 47064 | 95% UPL (t) | 57770 |
| 90% Percentile (z) | 42704 | 90% Percentile (z) | 47998 |
| 95% Percentile (z) | 46258 | 95% Percentile (z) | 55825 |
| 99% Percentile (z) | 52924 | 99% Percentile (z) | 74114 |

| Gamma Distribution Test | | Data Distribution Test |
|---|---|---|
| k star | 6.733 | Data appear Normal at 5% Significance Level |
| Theta Star | 4481 | |
| MLE of Mean | 30169 | |
| MLE of Standard Deviation | 11627 | |
| nu star | 404 | |
| A-D Test Statistic | 1.4 | |
| 5% A-D Critical Value | 0.746 | |
| K-S Test Statistic | 0.199 | |
| 5% K-S Critical Value | 0.16 | |
| Data not Gamma Distributed at 5% Significance Level | | |

| Nonparametric Statistics | |
|---|---|
| 90% Percentile | 43090 |
| 95% Percentile | 48195 |
| 99% Percentile | 54300 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 90% Percentile | 45697 | 95% UTL with 90% Coverage | 43200 |
| 95% Percentile | 51485 | 95% Percentile Bootstrap UTL with 90% Coverage | 43200 |
| 99% Percentile | 63555 | 95% BCA Bootstrap UTL with 90% Coverage | 43200 |
| | | 95% UPL | 48195 |
| | | 95% Chebyshev UPL | 73510 |
| 95% WH Approx. Gamma UPL | 52074 | Upper Threshold Limit Based upon IQR | 48388 |
| 95% HW Approx. Gamma UPL | 53183 | | |
| 95% WH Approx. Gamma UTL with 90% Coverage | 52880 | | |
| 95% HW Approx. Gamma UTL with 90% Coverage | 54064 | | |

Note: UPL represents a preferred estimate of BTV

**LEAD**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 27 | Number of Distinct Observations | 26 |

| Raw Statistics | | Log-Transformed Statistics | |
|---|---|---|---|
| Minimum | 8.1 | Minimum | 2.092 |
| Maximum | 29.8 | Maximum | 3.395 |
| Second Largest | 27.7 | Second Largest | 3.321 |
| First Quartile | 13.2 | First Quartile | 2.58 |
| Median | 17.8 | Median | 2.879 |
| Third Quartile | 21.8 | Third Quartile | 3.082 |
| Mean | 18.05 | Mean | 2.846 |
| SD | 5.45 | SD | 0.321 |
| Coefficient of Variation | 0.302 | | |
| Skewness | 0.229 | | |

**Background Statistics**

| Normal Distribution Test | | Lognormal Distribution Test | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.982 | Shapiro Wilk Test Statistic | 0.97 |
| Shapiro Wilk Critical Value | 0.923 | Shapiro Wilk Critical Value | 0.923 |
| Data appear Normal at 5% Significance Level | | Data appear Lognormal at 5% Significance Level | |

| Assuming Normal Distribution | | Assuming Lognormal Distribution | |
|---|---|---|---|
| 95% UTL with 90% Coverage | 27.92 | 95% UTL with 90% Coverage | 30.8 |
| 95% UPL (t) | 27.52 | 95% UPL (t) | 30.08 |
| 90% Percentile (z) | 25.03 | 90% Percentile (z) | 25.99 |
| 95% Percentile (z) | 27.01 | 95% Percentile (z) | 29.2 |
| 99% Percentile (z) | 30.73 | 99% Percentile (z) | 36.35 |

| Gamma Distribution Test | | Data Distribution Test |
|---|---|---|
| k star | 9.598 | Data appear Normal at 5% Significance Level |
| Theta Star | 1.88 | |
| MLE of Mean | 18.05 | |
| MLE of Standard Deviation | 5.826 | |
| nu star | 518.3 | |
| A-D Test Statistic | 0.178 | |
| 5% A-D Critical Value | 0.744 | |
| K-S Test Statistic | 0.0785 | |
| 5% K-S Critical Value | 0.168 | |
| Data appear Gamma Distributed at 5% Significance Level | | |

| Assuming Gamma Distribution | | Nonparametric Statistics | |
|---|---|---|---|
| 90% Percentile | 25.8 | 90% Percentile | 26.1 |
| 95% Percentile | 28.58 | 95% Percentile | 28.96 |
| 99% Percentile | 34.28 | 99% Percentile | 29.8 |
| | | 95% UTL with 90% Coverage | 27.7 |
| 95% WH Approx. Gamma UPL | 28.87 | 95% Percentile Bootstrap UTL with 90% Coverage | 28.33 |
| 95% HW Approx. Gamma UPL | 29.13 | 95% BCA Bootstrap UTL with 90% Coverage | 27.7 |
| 95% WH Approx. Gamma UTL with 90% Coverage | 29.45 | 95% UPL | 28.96 |
| 95% HW Approx. Gamma UTL with 90% Coverage | 29.73 | 95% Chebyshev UPL | 42.24 |
| | | Upper Threshold Limit Based upon IQR | 34.7 |

Note: UPL represents a preferred estimate of BTV

**MAGNESIUM**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 28 |

| Raw Statistics | | Log-Transformed Statistics | |
|---|---|---|---|
| Minimum | 625 | Minimum | 6.438 |
| Maximum | 6085 | Maximum | 8.714 |
| Second Largest | 5330 | Second Largest | 8.581 |
| First Quartile | 1705 | First Quartile | 7.441 |
| Median | 2580 | Median | 7.856 |
| Third Quartile | 3455 | Third Quartile | 8.147 |
| Mean | 2793 | Mean | 7.813 |
| SD | 1352 | SD | 0.526 |
| Coefficient of Variation | 0.484 | | |
| Skewness | 0.72 | | |

**Background Statistics**

| Normal Distribution Test | | Lognormal Distribution Test | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.949 | Shapiro Wilk Test Statistic | 0.97 |
| Shapiro Wilk Critical Value | 0.926 | Shapiro Wilk Critical Value | 0.926 |
| Data appear Normal at 5% Significance Level | | Data appear Lognormal at 5% Significance Level | |
| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
| 95% UTL with 90% Coverage | 5209 | 95% UTL with 90% Coverage | 6332 |
| 95% UPL (t) | 5131 | 95% UPL (t) | 6143 |
| 90% Percentile (z) | 4525 | 90% Percentile (z) | 4851 |
| 95% Percentile (z) | 5016 | 95% Percentile (z) | 5873 |
| 99% Percentile (z) | 5937 | 99% Percentile (z) | 8406 |

| Gamma Distribution Test | | Data Distribution Test |
|---|---|---|
| k star | 3.838 | Data appear Normal at 5% Significance Level |
| Theta Star | 727.7 | |
| MLE of Mean | 2793 | |
| MLE of Standard Deviation | 1426 | |
| nu star | 222.6 | |
| A-D Test Statistic | 0.191 | |
| 5% A-D Critical Value | 0.75 | |
| K-S Test Statistic | 0.0824 | |
| 5% K-S Critical Value | 0.163 | |
| Data appear Gamma Distributed at 5% Significance Level | | |

| Nonparametric Statistics | |
|---|---|
| 90% Percentile | 4940 |
| 95% Percentile | 5708 |
| 99% Percentile | 6085 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 90% Percentile | 4704 | 95% UTL with 90% Coverage | 5330 |
| 95% Percentile | 5474 | 95% Percentile Bootstrap UTL with 90% Coverage | 5406 |
| 99% Percentile | 7121 | 95% BCA Bootstrap UTL with 90% Coverage | 5406 |
| | | 95% UPL | 5708 |
| | | 95% Chebyshev UPL | 8785 |
| 95% WH Approx. Gamma UPL | 5564 | Upper Threshold Limit Based upon IQR | 6080 |
| 95% HW Approx. Gamma UPL | 5671 | | |
| 95% WH Approx. Gamma UTL with 90% Coverage | 5690 | | |
| 95% HW Approx. Gamma UTL with 90% Coverage | 5809 | | |

Note: UPL represents a preferred estimate of BTV

**MANGANESE**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 30 | Number of Distinct Observations | 29 |

**Raw Statistics**

| | |
|---|---|
| Minimum | 232 |
| Maximum | 1280 |
| Second Largest | 1210 |
| First Quartile | 484.5 |
| Median | 707.5 |
| Third Quartile | 890.3 |
| Mean | 706.5 |
| SD | 276.5 |
| Coefficient of Variation | 0.391 |
| Skewness | 0.199 |

**Log-Transformed Statistics**

| | |
|---|---|
| Minimum | 5.447 |
| Maximum | 7.155 |
| Second Largest | 7.098 |
| First Quartile | 6.183 |
| Median | 6.562 |
| Third Quartile | 6.791 |
| Mean | 6.475 |
| SD | 0.442 |

**Background Statistics**

**Normal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.974 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 1198 |
| 95% UPL (t) | 1184 |
| 90% Percentile (z) | 1061 |
| 95% Percentile (z) | 1161 |
| 99% Percentile (z) | 1350 |

**Gamma Distribution Test**

| | |
|---|---|
| k star | 5.425 |
| Theta Star | 130.2 |
| MLE of Mean | 706.5 |
| MLE of Standard Deviation | 303.3 |
| nu star | 325.5 |
| A-D Test Statistic | 0.315 |
| 5% A-D Critical Value | 0.746 |
| K-S Test Statistic | 0.139 |
| 5% K-S Critical Value | 0.16 |

Data appear Gamma Distributed at 5% Significance Level

**Assuming Gamma Distribution**

| | |
|---|---|
| 90% Percentile | 1112 |
| 95% Percentile | 1268 |
| 99% Percentile | 1595 |
| 95% WH Approx. Gamma UPL | 1285 |
| 95% HW Approx. Gamma UPL | 1307 |
| 95% WH Approx. Gamma UTL with 90% Coverage | 1307 |
| 95% HW Approx. Gamma UTL with 90% Coverage | 1330 |

**Lognormal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.947 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Lognormal at 5% Significance Level

**Assuming Lognormal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 1424 |
| 95% UPL (t) | 1393 |
| 90% Percentile (z) | 1143 |
| 95% Percentile (z) | 1343 |
| 99% Percentile (z) | 1815 |

**Data Distribution Test**

Data appear Normal at 5% Significance Level

**Nonparametric Statistics**

| | |
|---|---|
| 90% Percentile | 1102 |
| 95% Percentile | 1242 |
| 99% Percentile | 1280 |
| 95% UTL with 90% Coverage | 1210 |
| 95% Percentile Bootstrap UTL with 90% Coverage | 1210 |
| 95% BCA Bootstrap UTL with 90% Coverage | 1030 |
| 95% UPL | 1242 |
| 95% Chebyshev UPL | 1931 |
| Upper Threshold Limit Based upon IQR | 1499 |

Note: UPL represents a preferred estimate of BTV

MERCURY

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 20 |

| Raw Statistics | | Log-Transformed Statistics | |
|---|---|---|---|
| Minimum | 0.0615 | Minimum | -2.789 |
| Maximum | 0.34 | Maximum | -1.079 |
| Second Largest | 0.3 | Second Largest | -1.204 |
| First Quartile | 0.089 | First Quartile | -2.419 |
| Median | 0.12 | Median | -2.12 |
| Third Quartile | 0.25 | Third Quartile | -1.386 |
| Mean | 0.152 | Mean | -2.012 |
| SD | 0.0836 | SD | 0.504 |
| Coefficient of Variation | 0.549 | | |
| Skewness | 0.963 | | |

**Background Statistics**

| Normal Distribution Test | | Lognormal Distribution Test | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.815 | Shapiro Wilk Test Statistic | 0.891 |
| Shapiro Wilk Critical Value | 0.926 | Shapiro Wilk Critical Value | 0.926 |
| Data not Normal at 5% Significance Level | | Data not Lognormal at 5% Significance Level | |
| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
| 95% UTL with 90% Coverage | 0.302 | 95% UTL with 90% Coverage | 0.329 |
| 95% UPL (t) | 0.297 | 95% UPL (t) | 0.32 |
| 90% Percentile (z) | 0.259 | 90% Percentile (z) | 0.255 |
| 95% Percentile (z) | 0.29 | 95% Percentile (z) | 0.307 |
| 99% Percentile (z) | 0.347 | 99% Percentile (z) | 0.432 |
| **Gamma Distribution Test** | | **Data Distribution Test** | |
| k star | 3.614 | Data do not follow a Discernable Distribution (0.05) | |
| Theta Star | 0.0421 | | |
| MLE of Mean | 0.152 | | |
| MLE of Standard Deviation | 0.0801 | | |
| nu star | 209.6 | | |
| A-D Test Statistic | 1.655 | **Nonparametric Statistics** | |
| 5% A-D Critical Value | 0.75 | 90% Percentile | 0.285 |
| K-S Test Statistic | 0.199 | 95% Percentile | 0.32 |
| 5% K-S Critical Value | 0.163 | 99% Percentile | 0.34 |
| Data not Gamma Distributed at 5% Significance Level | | | |
| **Assuming Gamma Distribution** | | 95% UTL with 90% Coverage | 0.3 |
| 90% Percentile | 0.26 | 95% Percentile Bootstrap UTL with 90% Coverage | 0.3 |
| 95% Percentile | 0.303 | 95% BCA Bootstrap UTL with 90% Coverage | 0.304 |
| 99% Percentile | 0.397 | 95% UPL | 0.32 |
| | | 95% Chebyshev UPL | 0.523 |
| 95% WH Approx. Gamma UPL | 0.308 | Upper Threshold Limit Based upon IQR | 0.492 |
| 95% HW Approx. Gamma UPL | 0.311 | | |
| 95% WH Approx. Gamma UTL with 90% Coverage | 0.315 | | |
| 95% HW Approx. Gamma UTL with 90% Coverage | 0.318 | | |

Note: UPL represents a preferred estimate of BTV

NICKEL

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 28 |

| Raw Statistics | | Log-Transformed Statistics | |
|---|---|---|---|
| Minimum | 6.3 | Minimum | 1.841 |
| Maximum | 29.9 | Maximum | 3.398 |
| Second Largest | 21.8 | Second Largest | 3.082 |
| First Quartile | 9.75 | First Quartile | 2.277 |
| Median | 12.1 | Median | 2.493 |
| Third Quartile | 15.45 | Third Quartile | 2.734 |
| Mean | 13.31 | Mean | 2.527 |
| SD | 5.102 | SD | 0.352 |
| Coefficient of Variation | 0.383 | | |
| Skewness | 1.426 | | |

**Background Statistics**

| Normal Distribution Test | | Lognormal Distribution Test | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.893 | Shapiro Wilk Test Statistic | 0.981 |
| Shapiro Wilk Critical Value | 0.926 | Shapiro Wilk Critical Value | 0.926 |
| Data not Normal at 5% Significance Level | | Data appear Lognormal at 5% Significance Level | |
| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
| 95% UTL with 90% Coverage | 22.44 | 95% UTL with 90% Coverage | 23.48 |
| 95% UPL (t) | 22.14 | 95% UPL (t) | 23.01 |
| 90% Percentile (z) | 19.85 | 90% Percentile (z) | 19.65 |
| 95% Percentile (z) | 21.71 | 95% Percentile (z) | 22.33 |
| 99% Percentile (z) | 25.18 | 99% Percentile (z) | 28.39 |
| **Gamma Distribution Test** | | **Data Distribution Test** | |
| k star | 7.371 | Data appear Gamma Distributed at 5% Significance Level | |
| Theta Star | 1.806 | | |
| MLE of Mean | 13.31 | | |
| MLE of Standard Deviation | 4.904 | | |
| nu star | 427.5 | | |
| A-D Test Statistic | 0.419 | **Nonparametric Statistics** | |
| 5% A-D Critical Value | 0.746 | 90% Percentile | 20.9 |
| K-S Test Statistic | 0.148 | 95% Percentile | 25.85 |
| 5% K-S Critical Value | 0.163 | 99% Percentile | 29.9 |
| Data appear Gamma Distributed at 5% Significance Level | | | |
| **Assuming Gamma Distribution** | | 95% UTL with 90% Coverage | 21.8 |
| 90% Percentile | 19.86 | 95% Percentile Bootstrap UTL with 90% Coverage | 21.8 |
| 95% Percentile | 22.27 | 95% BCA Bootstrap UTL with 90% Coverage | 22.61 |
| 99% Percentile | 27.28 | 95% UPL | 25.85 |
| | | 95% Chebyshev UPL | 35.93 |
| 95% WH Approx. Gamma UPL | 22.5 | Upper Threshold Limit Based upon IQR | 24 |
| 95% HW Approx. Gamma UPL | 22.6 | | |
| 95% WH Approx. Gamma UTL with 90% Coverage | 22.89 | | |
| 95% HW Approx. Gamma UTL with 90% Coverage | 23 | | |

Note: UPL represents a preferred estimate of BTV

**POTASSIUM**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 30 | Number of Distinct Observations | 29 |

**Raw Statistics**

| | |
|---|---|
| Minimum | 276 |
| Maximum | 1710 |
| Second Largest | 1600 |
| First Quartile | 649.6 |
| Median | 759.5 |
| Third Quartile | 1115 |
| Mean | 847.8 |
| SD | 354.1 |
| Coefficient of Variation | 0.418 |
| Skewness | 0.753 |

**Log-Transformed Statistics**

| | |
|---|---|
| Minimum | 5.62 |
| Maximum | 7.444 |
| Second Largest | 7.378 |
| First Quartile | 6.476 |
| Median | 6.633 |
| Third Quartile | 7.017 |
| Mean | 6.656 |
| SD | 0.433 |

**Background Statistics**

**Normal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.939 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 1477 |
| 95% UPL (t) | 1459 |
| 90% Percentile (z) | 1302 |
| 95% Percentile (z) | 1430 |
| 99% Percentile (z) | 1672 |

**Gamma Distribution Test**

| | |
|---|---|
| k star | 5.372 |
| Theta Star | 157.8 |
| MLE of Mean | 847.8 |
| MLE of Standard Deviation | 365.8 |
| nu star | 322.3 |
| A-D Test Statistic | 0.373 |
| 5% A-D Critical Value | 0.746 |
| K-S Test Statistic | 0.121 |
| 5% K-S Critical Value | 0.16 |

Data appear Gamma Distributed at 5% Significance Level

**Assuming Gamma Distribution**

| | |
|---|---|
| 90% Percentile | 1337 |
| 95% Percentile | 1525 |
| 99% Percentile | 1921 |
| 95% WH Approx. Gamma UPL | 1545 |
| 95% HW Approx. Gamma UPL | 1564 |
| 95% WH Approx. Gamma UTL with 90% Coverage | 1571 |
| 95% HW Approx. Gamma UTL with 90% Coverage | 1592 |

**Lognormal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.968 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Lognormal at 5% Significance Level

**Assuming Lognormal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 1679 |
| 95% UPL (t) | 1644 |
| 90% Percentile (z) | 1355 |
| 95% Percentile (z) | 1586 |
| 99% Percentile (z) | 2131 |

**Data Distribution Test**

Data appear Normal at 5% Significance Level

**Nonparametric Statistics**

| | |
|---|---|
| 90% Percentile | 1436 |
| 95% Percentile | 1650 |
| 99% Percentile | 1710 |
| 95% UTL with 90% Coverage | 1600 |
| 95% Percentile Bootstrap UTL with 90% Coverage | 1600 |
| 95% BCA Bootstrap UTL with 90% Coverage | 1220 |
| 95% UPL | 1650 |
| 95% Chebyshev UPL | 2417 |
| Upper Threshold Limit Based upon IQR | 1813 |

Note: UPL represents a preferred estimate of BTV

**SELENIUM**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 30 | Number of Detected Data | 1 |
| Number of Distinct Detected Data | 1 | Number of Non-Detect Data | 29 |

**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**

**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**

**The data set for variable SELENIUM was not processed!**

SILVER

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 29 | Number of Detected Data | 2 |
| Number of Distinct Detected Data | 2 | Number of Non-Detect Data | 27 |
| | | Percent Non-Detects | 93.10% |

| Raw Statistics | | Log-transformed Statistics | |
|---|---|---|---|
| Minimum Detected | 0.21 | Minimum Detected | -1.561 |
| Maximum Detected | 0.22 | Maximum Detected | -1.514 |
| Mean of Detected | 0.215 | Mean of Detected | -1.537 |
| SD of Detected | 0.00707 | SD of Detected | 0.0329 |
| Minimum Non-Detect | 0.16 | Minimum Non-Detect | -1.833 |
| Maximum Non-Detect | 0.21 | Maximum Non-Detect | -1.561 |

**Data with Multiple Detection Limits**

Note: Data have multiple DLs - Use of KM Method is recommended

For all methods (except KM, DL/2, and ROS Methods),

Observations < Largest ND are treated as NDs

**Single Detection Limit Scenario**

| | |
|---|---|
| Number treated as Non-Detect with Single DL | 27 |
| Number treated as Detected with Single DL | 2 |
| Single DL Non-Detect Percentage | 93.10% |

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

SILVER continued

Background Statistics

**Normal Distribution Test with Detected Values Only**

| | |
|---|---|
| Shapiro Wilk Test Statistic | N/A |
| 5% Shapiro Wilk Critical Value | N/A |

Data not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | |
|---|---|---|
| DL/2 Substitution Method | | |
| Mean | | 0.102 |
| SD | | 0.0319 |
| 95% UTL | 90% Coverage | 0.159 |
| 95% UPL (t) | | 0.158 |
| 90% Percentile (z) | | 0.143 |
| 95% Percentile (z) | | 0.155 |
| 99% Percentile (z) | | 0.177 |
| Maximum Likelihood Estimate(MLE) Method | | N/A |

**Lognormal Distribution Test with Detected Values Only**

| | |
|---|---|
| Shapiro Wilk Test Statistic | N/A |
| 5% Shapiro Wilk Critical Value | N/A |

Data not Lognormal at 5% Significance Level

**Assuming Lognormal Distribution**

| | | |
|---|---|---|
| DL/2 Substitution Method | | |
| Mean (Log Scale) | | -2.311 |
| SD (Log Scale) | | 0.226 |
| 95% UTL | 90% Coverage | 0.149 |
| 95% UPL (t) | | 0.147 |
| 90% Percentile (z) | | 0.132 |
| 95% Percentile (z) | | 0.144 |
| 99% Percentile (z) | | 0.168 |
| Log ROS Method | | |
| Mean in Original Scale | | N/A |
| SD in Original Scale | | N/A |
| Mean in Log Scale | | N/A |
| SD in Log Scale | | N/A |
| 95% UTL | 90% Coverage | N/A |
| 95% UPL (t) | | N/A |
| 90% Percentile (z) | | N/A |
| 95% Percentile (z) | | N/A |
| 99% Percentile (z) | | N/A |

**Gamma Distribution Test with Detected Values Only**

| | |
|---|---|
| k star (bias corrected) | N/A |
| Theta Star | N/A |
| nu star | N/A |
| A-D Test Statistic | N/A |
| 5% A-D Critical Value | N/A |
| K-S Test Statistic | N/A |
| 5% K-S Critical Value | N/A |

Data not Gamma Distributed at 5% Significance Level

**Assuming Gamma Distribution**

| | |
|---|---|
| Gamma ROS Statistics with Extrapolated Data | |
| Mean | N/A |
| Median | N/A |
| SD | N/A |
| k star | N/A |
| Theta star | N/A |
| Nu star | N/A |
| 95% Percentile of Chisquare (2k) | N/A |
| 90% Percentile | N/A |
| 95% Percentile | N/A |
| 99% Percentile | N/A |

**Data Distribution Test with Detected Values Only**

Data do not follow a Discernable Distribution (0.05)

**Nonparametric Statistics**

| | | |
|---|---|---|
| Kaplan-Meier (KM) Method | | |
| Mean | | 0.21 |
| SD | | 0.00182 |
| SE of Mean | | 0.0004792 |
| 95% KM UTL with | 90% Coverage | 0.214 |
| 95% KM Chebyshev UPL | | 0.218 |
| 95% KM UPL (t) | | 0.214 |
| 90% Percentile (z) | | 0.213 |
| 95% Percentile (z) | | 0.213 |
| 99% Percentile (z) | | 0.215 |

**Gamma ROS Limits with Extrapolated Data**

| | | |
|---|---|---|
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | | N/A |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | | N/A |
| 95% WH Approx. Gamma UTL with | 90% Coverage | N/A |
| 95% HW Approx. Gamma UTL with | 90% Coverage | N/A |

Note: UPL represents a preferred estimate of BTV

For an Example: KM-UPL may be used when multiple detection limits are present

Note: DL/2 is not a recommended method.

**SODIUM**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 30 | Number of Detected Data | 20 |
| Number of Distinct Detected Data | 19 | Number of Non-Detect Data | 10 |
| | | Percent Non-Detects | 33.33% |

**Raw Statistics**

| | |
|---|---|
| Minimum Detected | 98.1 |
| Maximum Detected | 271 |
| Mean of Detected | 165.2 |
| SD of Detected | 56.24 |
| Minimum Non-Detect | 92 |
| Maximum Non-Detect | 100 |

**Log-transformed Statistics**

| | |
|---|---|
| Minimum Detected | 4.586 |
| Maximum Detected | 5.602 |
| Mean of Detected | 5.055 |
| SD of Detected | 0.327 |
| Minimum Non-Detect | 4.522 |
| Maximum Non-Detect | 4.605 |

**Data with Multiple Detection Limits**

Note: Data have multiple DLs - Use of KM Method is recommended

For all methods (except KM, DL/2, and ROS Methods),

Observations < Largest ND are treated as NDs

**Single Detection Limit Scenario**

| | |
|---|---|
| Number treated as Non-Detect with Single DL | 11 |
| Number treated as Detected with Single DL | 19 |
| Single DL Non-Detect Percentage | 36.67% |

**Background Statistics**

**Normal Distribution Test with Detected Values Only**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.89 |
| 5% Shapiro Wilk Critical Value | 0.905 |

Data not Normal at 5% Significance Level

**Lognormal Distribution Test with Detected Values Only**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.929 |
| 5% Shapiro Wilk Critical Value | 0.905 |

Data appear Lognormal at 5% Significance Level

**Assuming Normal Distribution**

DL/2 Substitution Method

| | |
|---|---|
| Mean | 126.2 |
| SD | 72.28 |
| 95% UTL 90% Coverage | 254.6 |
| 95% UPL (t) | 251 |
| 90% Percentile (z) | 218.8 |
| 95% Percentile (z) | 245 |
| 99% Percentile (z) | 294.3 |

Maximum Likelihood Estimate(MLE) Method

| | |
|---|---|
| Mean | 123.7 |
| SD | 77.48 |
| 95% UTL with 90% Coverage | 261.4 |
| 95% UPL (t) | 257.6 |
| 90% Percentile (z) | 223 |
| 95% Percentile (z) | 251.2 |
| 99% Percentile (z) | 304 |

**Assuming Lognormal Distribution**

DL/2 Substitution Method

| | |
|---|---|
| Mean (Log Scale) | 4.661 |
| SD (Log Scale) | 0.626 |
| 95% UTL 90% Coverage | 321.5 |
| 95% UPL (t) | 311.6 |
| 90% Percentile (z) | 235.8 |
| 95% Percentile (z) | 296 |
| 99% Percentile (z) | 453.3 |

Log ROS Method

| | |
|---|---|
| Mean in Original Scale | 134.2 |
| SD in Original Scale | 63.84 |
| 95% UTL with 90% Coverage | 275.2 |
| 95% BCA UTL with 90% Coverage | 265 |
| 95% Bootstrap (%) UTL with 90% Coverage | 265 |
| 95% UPL (t) | 268.9 |
| 90% Percentile (z) | 218.8 |
| 95% Percentile (z) | 258.9 |
| 99% Percentile (z) | 354.9 |

**Gamma Distribution Test with Detected Values Only**

| | |
|---|---|
| k star (bias corrected) | 8.34 |
| Theta Star | 19.81 |
| nu star | 333.6 |
| A-D Test Statistic | 0.603 |
| 5% A-D Critical Value | 0.742 |
| K-S Test Statistic | 0.143 |
| 5% K-S Critical Value | 0.194 |

Data appear Gamma Distributed at 5% Significance Level

**Data Distribution Test with Detected Values Only**

Data appear Gamma Distributed at 5% Significance Level

**Assuming Gamma Distribution**

Gamma ROS Statistics with Extrapolated Data

| | |
|---|---|
| Mean | 150.5 |
| Median | 135.5 |
| SD | 51.87 |
| k star | 9.012 |
| Theta star | 16.7 |
| Nu star | 540.7 |
| 95% Percentile of Chisquare (2k) | 28.9 |
| 90% Percentile | 217.2 |
| 95% Percentile | 241.3 |
| 99% Percentile | 290.9 |

**Nonparametric Statistics**

Kaplan-Meier (KM) Method

| | |
|---|---|
| Mean | 142.8 |
| SD | 54.8 |
| SE of Mean | 10.26 |
| 95% KM UTL with 90% Coverage | 240.2 |
| 95% KM Chebyshev UPL | 385.6 |
| 95% KM UPL (t) | 237.5 |
| 90% Percentile (z) | 213 |
| 95% Percentile (z) | 233 |
| 99% Percentile (z) | 270.3 |

**Gamma ROS Limits with Extrapolated Data**

| | |
|---|---|
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | 243.5 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | 244.2 |
| 95% WH Approx. Gamma UTL with 90% Coverage | 246.8 |
| 95% HW Approx. Gamma UTL with 90% Coverage | 247.6 |

Note: UPL represents a preferred estimate of BTV

For an Example: KM-UPL may be used when multiple detection limits are present

Note: DL/2 is not a recommended method.

**THALLIUM**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 30 | Number of Detected Data | 2 |
| Number of Distinct Detected Data | 2 | Number of Non-Detect Data | 28 |
| | | Percent Non-Detects | 93.33% |

| Raw Statistics | | Log-transformed Statistics | |
|---|---|---|---|
| Minimum Detected | 0.92 | Minimum Detected | -0.0834 |
| Maximum Detected | 1.1 | Maximum Detected | 0.0953 |
| Mean of Detected | 1.01 | Mean of Detected | 0.00596 |
| SD of Detected | 0.127 | SD of Detected | 0.126 |
| Minimum Non-Detect | 0.83 | Minimum Non-Detect | -0.186 |
| Maximum Non-Detect | 1.1 | Maximum Non-Detect | 0.0953 |

**Data with Multiple Detection Limits**

Note: Data have multiple DLs - Use of KM Method is recommended

For all methods (except KM, DL/2, and ROS Methods),

Observations < Largest ND are treated as NDs

**Single Detection Limit Scenario**

| | |
|---|---|
| Number treated as Non-Detect with Single DL | 29 |
| Number treated as Detected with Single DL | 1 |
| Single DL Non-Detect Percentage | 96.67% |

**Warning: Data set has only 2 Distinct Detected Values.**

**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**

**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**

**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**

**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**

**Those methods will return a 'N/A' value on your output display!**

**It is necessary to have 4 or more Distinct Values for bootstrap methods.**

**However, results obtained using 4 to 9 distinct values may not be reliable.**

**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**

## Background Statistics

### Normal Distribution Test with Detected Values Only

| | |
|---|---|
| Shapiro Wilk Test Statistic | N/A |
| 5% Shapiro Wilk Critical Value | N/A |

Data not Normal at 5% Significance Level

### Assuming Normal Distribution

DL/2 Substitution Method

| | | |
|---|---|---|
| Mean | | 0.532 |
| SD | | 0.137 |
| 95% UTL | 90% Coverage | 0.775 |
| 95% UPL (t) | | 0.768 |
| 90% Percentile (z) | | 0.707 |
| 95% Percentile (z) | | 0.757 |
| 99% Percentile (z) | | 0.85 |

Maximum Likelihood Estimate(MLE) Method N/A

### Lognormal Distribution Test with Detected Values Only

| | |
|---|---|
| Shapiro Wilk Test Statistic | N/A |
| 5% Shapiro Wilk Critical Value | N/A |

Data not Lognormal at 5% Significance Level

### Assuming Lognormal Distribution

DL/2 Substitution Method

| | | |
|---|---|---|
| Mean (Log Scale) | | -0.654 |
| SD (Log Scale) | | 0.195 |
| 95% UTL | 90% Coverage | 0.736 |
| 95% UPL (t) | | 0.728 |
| 90% Percentile (z) | | 0.668 |
| 95% Percentile (z) | | 0.717 |
| 99% Percentile (z) | | 0.819 |

Log ROS Method

| | | |
|---|---|---|
| Mean in Original Scale | | N/A |
| SD in Original Scale | | N/A |
| Mean in Log Scale | | N/A |
| SD in Log Scale | | N/A |
| 95% UTL | 90% Coverage | N/A |
| 95% UPL (t) | | N/A |
| 90% Percentile (z) | | N/A |
| 95% Percentile (z) | | N/A |
| 99% Percentile (z) | | N/A |

### Gamma Distribution Test with Detected Values Only

| | |
|---|---|
| k star (bias corrected) | N/A |
| Theta Star | N/A |
| nu star | N/A |
| A-D Test Statistic | N/A |
| 5% A-D Critical Value | N/A |
| K-S Test Statistic | N/A |
| 5% K-S Critical Value | N/A |

Data not Gamma Distributed at 5% Significance Level

### Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

| | |
|---|---|
| Mean | N/A |
| Median | N/A |
| SD | N/A |
| k star | N/A |
| Theta star | N/A |
| Nu star | N/A |
| 95% Percentile of Chisquare (2k) | N/A |
| 90% Percentile | N/A |
| 95% Percentile | N/A |
| 99% Percentile | N/A |

### Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

### Nonparametric Statistics

Kaplan-Meier (KM) Method

| | | |
|---|---|---|
| Mean | | 0.926 |
| SD | | 0.0323 |
| SE of Mean | | 0.00834 |
| 95% KM UTL with | 90% Coverage | 0.983 |
| 95% KM Chebyshev UPL | | 1.069 |
| 95% KM UPL (t) | | 0.982 |
| 90% Percentile (z) | | 0.967 |
| 95% Percentile (z) | | 0.979 |
| 99% Percentile (z) | | 1.001 |

### Gamma ROS Limits with Extrapolated Data

| | | |
|---|---|---|
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | | N/A |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | | N/A |
| 95% WH Approx. Gamma UTL with | 90% Coverage | N/A |
| 95% HW Approx. Gamma UTL with | 90% Coverage | N/A |

Note: UPL represents a preferred estimate of BTV

For an Example: KM-UPL may be used when multiple detection limits are present

Note: DL/2 is not a recommended method.

VANADIUM

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 30 | Number of Distinct Observations | 30 |

**Raw Statistics**

| | |
|---|---|
| Minimum | 46.2 |
| Maximum | 176 |
| Second Largest | 147 |
| First Quartile | 77.58 |
| Median | 91.75 |
| Third Quartile | 106.5 |
| Mean | 96.13 |
| SD | 28.5 |
| Coefficient of Variation | 0.297 |
| Skewness | 0.818 |

**Log-Transformed Statistics**

| | |
|---|---|
| Minimum | 3.833 |
| Maximum | 5.17 |
| Second Largest | 4.99 |
| First Quartile | 4.351 |
| Median | 4.519 |
| Third Quartile | 4.668 |
| Mean | 4.524 |
| SD | 0.298 |

**Background Statistics**

**Normal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.941 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Normal at 5% Significance Level

**Lognormal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.963 |
| Shapiro Wilk Critical Value | 0.927 |

Data appear Lognormal at 5% Significance Level

**Assuming Normal Distribution**

| | | |
|---|---|---|
| 95% UTL with | 90% Coverage | 146.8 |
| 95% UPL (t) | | 145.4 |
| 90% Percentile (z) | | 132.7 |
| 95% Percentile (z) | | 143 |
| 99% Percentile (z) | | 162.4 |

**Assuming Lognormal Distribution**

| | | |
|---|---|---|
| 95% UTL with | 90% Coverage | 156.4 |
| 95% UPL (t) | | 154.1 |
| 90% Percentile (z) | | 135 |
| 95% Percentile (z) | | 150.4 |
| 99% Percentile (z) | | 184.2 |

**Gamma Distribution Test**

| | |
|---|---|
| k star | 10.89 |
| Theta Star | 8.824 |
| MLE of Mean | 96.13 |
| MLE of Standard Deviation | 29.12 |
| nu star | 653.6 |
| A-D Test Statistic | 0.461 |
| 5% A-D Critical Value | 0.745 |
| K-S Test Statistic | 0.128 |
| 5% K-S Critical Value | 0.16 |

Data appear Gamma Distributed at 5% Significance Level

**Data Distribution Test**

Data appear Normal at 5% Significance Level

**Nonparametric Statistics**

| | |
|---|---|
| 90% Percentile | 143 |
| 95% Percentile | 160.1 |
| 99% Percentile | 176 |

**Assuming Gamma Distribution**

| | | |
|---|---|---|
| 90% Percentile | | 134.8 |
| 95% Percentile | | 148.5 |
| 99% Percentile | | 176.5 |
| 95% WH Approx. Gamma UPL | | 149.7 |
| 95% HW Approx. Gamma UPL | | 150.6 |
| 95% WH Approx. Gamma UTL with | 90% Coverage | 151.6 |
| 95% HW Approx. Gamma UTL with | 90% Coverage | 152.6 |

| | | |
|---|---|---|
| 95% UTL with | 90% Coverage | 147 |
| 95% Percentile Bootstrap UTL with | 90% Coverage | 147 |
| 95% BCA Bootstrap UTL with | 90% Coverage | 147 |
| 95% UPL | | 160.1 |
| 95% Chebyshev UPL | | 222.4 |
| Upper Threshold Limit Based upon IQR | | 149.9 |

Note: UPL represents a preferred estimate of BTV

**ZINC**

**General Statistics**

| | |
|---|---|
| Total Number of Observations | 27 |
| Number of Distinct Observations | 26 |

**Raw Statistics**

| | |
|---|---|
| Minimum | 27.6 |
| Maximum | 91.1 |
| Second Largest | 86.3 |
| First Quartile | 40.9 |
| Median | 53.5 |
| Third Quartile | 61.7 |
| Mean | 52.96 |
| SD | 16.17 |
| Coefficient of Variation | 0.305 |
| Skewness | 0.543 |

**Log-Transformed Statistics**

| | |
|---|---|
| Minimum | 3.318 |
| Maximum | 4.512 |
| Second Largest | 4.458 |
| First Quartile | 3.711 |
| Median | 3.98 |
| Third Quartile | 4.122 |
| Mean | 3.924 |
| SD | 0.311 |

**Background Statistics**

**Normal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.96 |
| Shapiro Wilk Critical Value | 0.923 |

Data appear Normal at 5% Significance Level

**Lognormal Distribution Test**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.973 |
| Shapiro Wilk Critical Value | 0.923 |

Data appear Lognormal at 5% Significance Level

**Assuming Normal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 82.24 |
| 95% UPL (t) | 81.04 |
| 90% Percentile (z) | 73.68 |
| 95% Percentile (z) | 79.55 |
| 99% Percentile (z) | 90.57 |

**Assuming Lognormal Distribution**

| | |
|---|---|
| 95% UTL with 90% Coverage | 88.84 |
| 95% UPL (t) | 86.82 |
| 90% Percentile (z) | 75.36 |
| 95% Percentile (z) | 84.37 |
| 99% Percentile (z) | 104.3 |

**Gamma Distribution Test**

| | |
|---|---|
| k star | 9.946 |
| Theta Star | 5.325 |
| MLE of Mean | 52.96 |
| MLE of Standard Deviation | 16.79 |
| nu star | 537.1 |
| A-D Test Statistic | 0.229 |
| 5% A-D Critical Value | 0.744 |
| K-S Test Statistic | 0.0963 |
| 5% K-S Critical Value | 0.168 |

Data appear Gamma Distributed at 5% Significance Level

**Data Distribution Test**

Data appear Normal at 5% Significance Level

**Nonparametric Statistics**

| | |
|---|---|
| 90% Percentile | 75.26 |
| 95% Percentile | 89.18 |
| 99% Percentile | 91.1 |
| 95% UTL with 90% Coverage | 86.3 |
| 95% Percentile Bootstrap UTL with 90% Coverage | 86.3 |
| 95% BCA Bootstrap UTL with 90% Coverage | 86.3 |
| 95% UPL | 89.18 |
| 95% Chebyshev UPL | 124.7 |
| Upper Threshold Limit Based upon IQR | 92.9 |

**Assuming Gamma Distribution**

| | |
|---|---|
| 90% Percentile | 75.3 |
| 95% Percentile | 83.26 |
| 99% Percentile | 99.62 |
| 95% WH Approx. Gamma UPL | 84.1 |
| 95% HW Approx. Gamma UPL | 84.68 |
| 95% WH Approx. Gamma UTL with 90% Coverage | 85.74 |
| 95% HW Approx. Gamma UTL with 90% Coverage | 86.4 |

Note: UPL represents a preferred estimate of BTV

# Attachment 6

Raw Data and ProUCL Summary Statistics - Pesticides

Fort Buchanan Background Pesticides and Herbicides Data for Soil

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample Name:** | S12-SCHOOL-11-1 | S12-SCHOOL-11-2 | S12-SCHOOL-11-3 | S12-SCHOOL-11-DP2 | S12-SCHOOL-11-4 |
| | | | | **Parent Sample Name:** | | | | S12-SCHOOL-11-3 | |
| | | | | **Sample Date:** | 9/21/2011 | 9/21/2011 | 9/21/2011 | 9/21/2011 | 9/20/2011 |
| **Analyte** | **Min** | **Max** | **No. Detects** | **Units** | | | | | |
| **Pesticides** | | | | | | | | | |
| 4,4-DDD | 502 | 502 | 1 | ug/kg | 502 | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| 4,4-DDE | 2 | 650 | 7 | ug/kg | 650 | 3.2 | 2 | 2 J | 0.82 U |
| 4,4-DDT | 1.5 | 198 | 7 | ug/kg | 198 | 2.7 | 1.5 | 2.6 | 0.82 U |
| Aldrin | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| alpha-BHC | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| alpha-Chlordane | 9 | 9 | 1 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 9 | 0.82 U |
| Beta-BHC | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| delta-BHC | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| Dieldrin | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| Endosulfan I | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| Endosulfan II | 8.2 | 8.2 | 1 | ug/kg | 8.2 | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| Endosulfan sulfate | 2.2 | 2.2 | 1 | ug/kg | 2.2 J | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| Endrin | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| Endrin aldehyde | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| Endrin ketone | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| Gamma-BHC (Lindane) | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| Heptachlor | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| Heptachlor epoxide | -- | -- | 0 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 0.77 U | 0.82 U |
| Methoxychlor | -- | -- | 0 | ug/kg | 1.5 U | 1.6 U | 1.5 U | 1.5 U | 1.6 U |
| Toxaphene | -- | -- | 0 | ug/kg | 18 U | 20 U | 19 U | 19 U | 20 U |
| trans-Chlordane | 8.5 | 8.5 | 1 | ug/kg | 0.74 U | 0.79 U | 0.77 U | 8.5 | 0.82 U |
| **Herbicides** | | | | | | | | | |
| 2,2-dichloropropionic acid | -- | -- | 0 | ug/kg | 3.6 U | 3.8 U | 3.8 U | 3.7 U | 4 U |
| 2,4,5-T | -- | -- | 0 | ug/kg | 3.6 U | 3.8 U | 3.8 U | 3.7 U | 4 U |
| 2,4,5-TP (silvex) | -- | -- | 0 | ug/kg | 3.6 U | 3.8 U | 3.8 U | 3.7 U | 4 U |
| 2,4-D | -- | -- | 0 | ug/kg | 18 U | 19 U | 19 U | 19 U | 20 U |
| 2,4-DB | -- | -- | 0 | ug/kg | 18 U | 19 U | 19 U | 19 U | 20 U |
| Dicamba | -- | -- | 0 | ug/kg | 3.6 U | 3.8 U | 3.8 U | 3.7 U | 4 U |
| Dichlorprop | -- | -- | 0 | ug/kg | 18 U | 19 U | 19 U | 19 U | 20 U |
| Dinoseb | -- | -- | 0 | ug/kg | 18 U | 19 U | 19 U | 19 U | 20 U |
| MCPA (2-methyl-4-chlorophenoxyacetic acid) | -- | -- | 0 | ug/kg | 1800 U | 1900 U | 1900 U | 1900 U | 2000 U |
| MCPP | -- | -- | 0 | ug/kg | 1800 U | 1900 U | 1900 U | 1900 U | 2000 U |
| Pentachlorophenol | -- | -- | 0 | ug/kg | 1.8 U | 1.9 U | 1.9 U | 1.9 U | 2 U |

Fort Buchanan Background Pesticides and Herbicides Data for Soil

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample Name:** | S12-SCHOOL-11-1 | S12-SCHOOL-11-2 | S12-SCHOOL-11-3 | S12-SCHOOL-11-DP2 | S12-SCHOOL-11-4 |
| | | | | **Parent Sample Name:** | | | | S12-SCHOOL-11-3 | |
| | | | | **Sample Date:** | 9/21/2011 | 9/21/2011 | 9/21/2011 | 9/21/2011 | 9/20/2011 |
| **Analyte** | **Min** | **Max** | **No. Detects** | **Units** | | | | | |
| **Geology/Soil Type** | | | | | | | | | |
| Geology | -- | -- | -- | -- | Alluvium | Alluvium | Alluvium | Alluvium | Cibao Formation |
| Soil Order | -- | -- | -- | -- | Alfisols | Oxisol | Alfisols | Alfisols | Oxisol |

Notes:
Min = Minimum detected concentration
Max = Maximum detected concentration
No. Detects = Number of positive detections out of the 13 samples, including field duplicates
J = Estimated value
U = Not detected, value presented in the reporting limit

Fort Buchanan Background Pesticides and Herbicides Data for Soil

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample Name:** | S12-SCHOOL-11-5 | S12-SCHOOL-11-6 | S12-SCHOOL-11-7 | S12-SCHOOL-11-8 | S12-SCHOOL-11-9 |
| | | | | **Parent Sample Name:** | | | | | |
| | | | | **Sample Date:** | 9/20/2011 | 9/21/2011 | 9/20/2011 | 9/21/2011 | 9/21/2011 |
| **Analyte** | **Min** | **Max** | **No. Detects** | **Units** | | | | | |
| **Pesticides** | | | | | | | | | |
| 4,4-DDD | 502 | 502 | 1 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| 4,4-DDE | 2 | 650 | 7 | ug/kg | 0.79 U | 3.3 | 0.82 U | 3 | 0.71 U |
| 4,4-DDT | 1.5 | 198 | 7 | ug/kg | 1.7 | 0.96 U | 0.82 U | 0.83 U | 1.9 |
| Aldrin | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| alpha-BHC | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| alpha-Chlordane | 9 | 9 | 1 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Beta-BHC | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| delta-BHC | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Dieldrin | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Endosulfan I | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Endosulfan II | 8.2 | 8.2 | 1 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Endosulfan sulfate | 2.2 | 2.2 | 1 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Endrin | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Endrin aldehyde | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Endrin ketone | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Gamma-BHC (Lindane) | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Heptachlor | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Heptachlor epoxide | -- | -- | 0 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| Methoxychlor | -- | -- | 0 | ug/kg | 1.6 U | 1.9 U | 1.6 U | 1.7 U | 1.4 U |
| Toxaphene | -- | -- | 0 | ug/kg | 20 U | 24 U | 20 U | 21 U | 18 U |
| trans-Chlordane | 8.5 | 8.5 | 1 | ug/kg | 0.79 U | 0.96 U | 0.82 U | 0.83 U | 0.71 U |
| **Herbicides** | | | | | | | | | |
| 2,2-dichloropropionic acid | -- | -- | 0 | ug/kg | 3.8 U | 4.7 U | 4 U | 4 U | 3.5 U |
| 2,4,5-T | -- | -- | 0 | ug/kg | 3.8 U | 4.7 U | 4 U | 4 U | 3.5 U |
| 2,4,5-TP (silvex) | -- | -- | 0 | ug/kg | 3.8 U | 4.7 U | 4 U | 4 U | 3.5 U |
| 2,4-D | -- | -- | 0 | ug/kg | 19 U | 23 U | 20 U | 20 U | 17 U |
| 2,4-DB | -- | -- | 0 | ug/kg | 19 U | 23 U | 20 U | 20 U | 17 U |
| Dicamba | -- | -- | 0 | ug/kg | 3.8 U | 4.7 U | 4 U | 4 U | 3.5 U |
| Dichlorprop | -- | -- | 0 | ug/kg | 19 U | 23 U | 20 U | 20 U | 17 U |
| Dinoseb | -- | -- | 0 | ug/kg | 19 U | 23 U | 20 U | 20 U | 17 U |
| MCPA (2-methyl-4-chlorophenoxyacetic acid) | -- | -- | 0 | ug/kg | 1900 U | 2300 U | 2000 U | 2000 U | 1700 U |
| MCPP | -- | -- | 0 | ug/kg | 1900 U | 2300 U | 2000 U | 2000 U | 1700 U |
| Pentachlorophenol | -- | -- | 0 | ug/kg | 1.9 U | 2.3 U | 2 U | 2 U | 1.7 U |

Fort Buchanan Background Pesticides and Herbicides Data for Soil

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample Name:** | S12-SCHOOL-11-5 | S12-SCHOOL-11-6 | S12-SCHOOL-11-7 | S12-SCHOOL-11-8 | S12-SCHOOL-11-9 |
| | | | | **Parent Sample Name:** | | | | | |
| | | | | **Sample Date:** | 9/20/2011 | 9/21/2011 | 9/20/2011 | 9/21/2011 | 9/21/2011 |
| **Analyte** | **Min** | **Max** | **No. Detects** | **Units** | | | | | |
| **Geology/Soil Type** | | | | | | | | | |
| Geology | -- | -- | -- | -- | Cibao Formation | Mucarabones Sand | Cibao Formation | Mucarabones Sand | Alluvium |
| Soil Order | -- | -- | -- | -- | Oxisol | Oxisol | Oxisol | Oxisol | Alfisols |

Notes:
Min = Minimum detected concentration
Max = Maximum detected concentration
No. Detects = Number of positive detections out of the 13 samples, including field du
J = Estimated value
U = Not detected, value presented in the reporting limit

Fort Buchanan Background Pesticides and Herbicides Data for Soil

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | **Sample Name:** | S12-SCHOOL-11-10 | S12-SCHOOL-11-11 | S12-SCHOOL-11-12 |
| | | | | **Parent Sample Name:** | | | |
| | | | | **Sample Date:** | 9/21/2011 | 9/21/2011 | 9/21/2011 |
| **Analyte** | **Min** | **Max** | **No. Detects** | **Units** | | | |
| **Pesticides** | | | | | | | |
| 4,4-DDD | 502 | 502 | 1 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| 4,4-DDE | 2 | 650 | 7 | ug/kg | 0.77 U | 0.7 U | 2.7 |
| 4,4-DDT | 1.5 | 198 | 7 | ug/kg | 0.77 U | 0.7 U | 2.7 |
| Aldrin | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| alpha-BHC | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| alpha-Chlordane | 9 | 9 | 1 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Beta-BHC | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| delta-BHC | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Dieldrin | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Endosulfan I | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Endosulfan II | 8.2 | 8.2 | 1 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Endosulfan sulfate | 2.2 | 2.2 | 1 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Endrin | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Endrin aldehyde | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Endrin ketone | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Gamma-BHC (Lindane) | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Heptachlor | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Heptachlor epoxide | -- | -- | 0 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| Methoxychlor | -- | -- | 0 | ug/kg | 1.5 U | 1.4 U | 2 U |
| Toxaphene | -- | -- | 0 | ug/kg | 19 U | 18 U | 25 U |
| trans-Chlordane | 8.5 | 8.5 | 1 | ug/kg | 0.77 U | 0.7 U | 0.99 U |
| **Herbicides** | | | | | | | |
| 2,2-dichloropropionic acid | -- | -- | 0 | ug/kg | 3.7 U | 3.4 U | 4.8 U |
| 2,4,5-T | -- | -- | 0 | ug/kg | 3.7 U | 3.4 U | 4.8 U |
| 2,4,5-TP (silvex) | -- | -- | 0 | ug/kg | 3.7 U | 3.4 U | 4.8 U |
| 2,4-D | -- | -- | 0 | ug/kg | 19 U | 17 U | 24 U |
| 2,4-DB | -- | -- | 0 | ug/kg | 19 U | 17 U | 24 U |
| Dicamba | -- | -- | 0 | ug/kg | 3.7 U | 3.4 U | 4.8 U |
| Dichlorprop | -- | -- | 0 | ug/kg | 19 U | 17 U | 24 U |
| Dinoseb | -- | -- | 0 | ug/kg | 19 U | 17 U | 24 U |
| MCPA (2-methyl-4-chlorophenoxyacetic acid) | -- | -- | 0 | ug/kg | 1900 U | 1700 U | 2400 U |
| MCPP | -- | -- | 0 | ug/kg | 1900 U | 1700 U | 2400 U |
| Pentachlorophenol | -- | -- | 0 | ug/kg | 1.9 U | 1.7 U | 2.4 U |

Fort Buchanan Background Pesticides and Herbicides Data for Soil

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | **Sample Name:** | S12-SCHOOL-11-10 | S12-SCHOOL-11-11 | S12-SCHOOL-11-12 |
| | | | | **Parent Sample Name:** | | | |
| | | | | **Sample Date:** | 9/21/2011 | 9/21/2011 | 9/21/2011 |
| **Analyte** | **Min** | **Max** | **No. Detects** | **Units** | | | |
| **Geology/Soil Type** | | | | | | | |
| Geology | -- | -- | -- | -- | Alluvium | Alluvium | Mucarabones Sand |
| Soil Order | -- | -- | -- | -- | Ultisol | Alfisols | Ultisol |

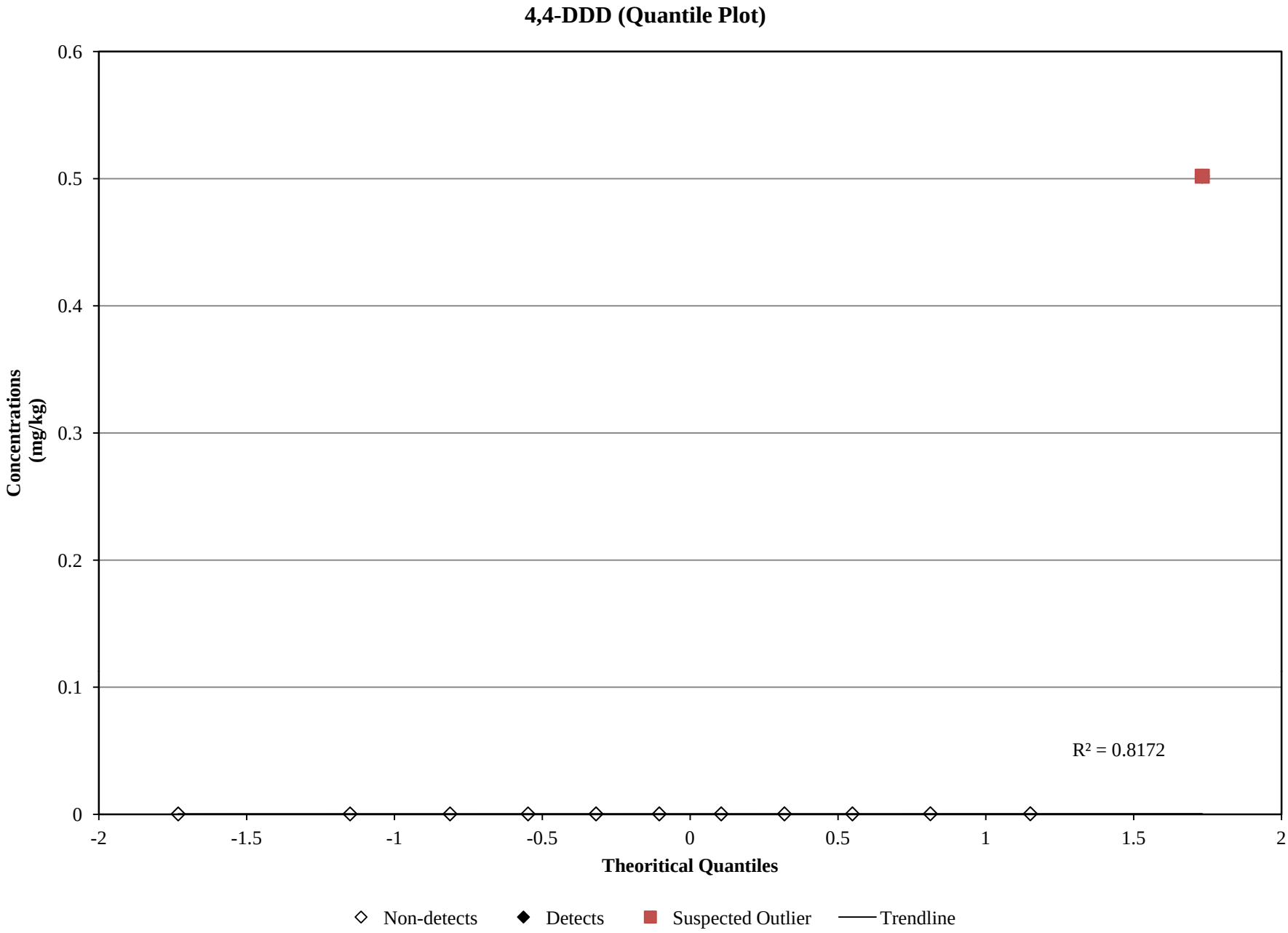
Notes:
Min = Minimum detected concentration
Max = Maximum detected concentration
No. Detects = Number of positive detections out of the 13 samples, including field du
J = Estimated value
U = Not detected, value presented in the reporting limit

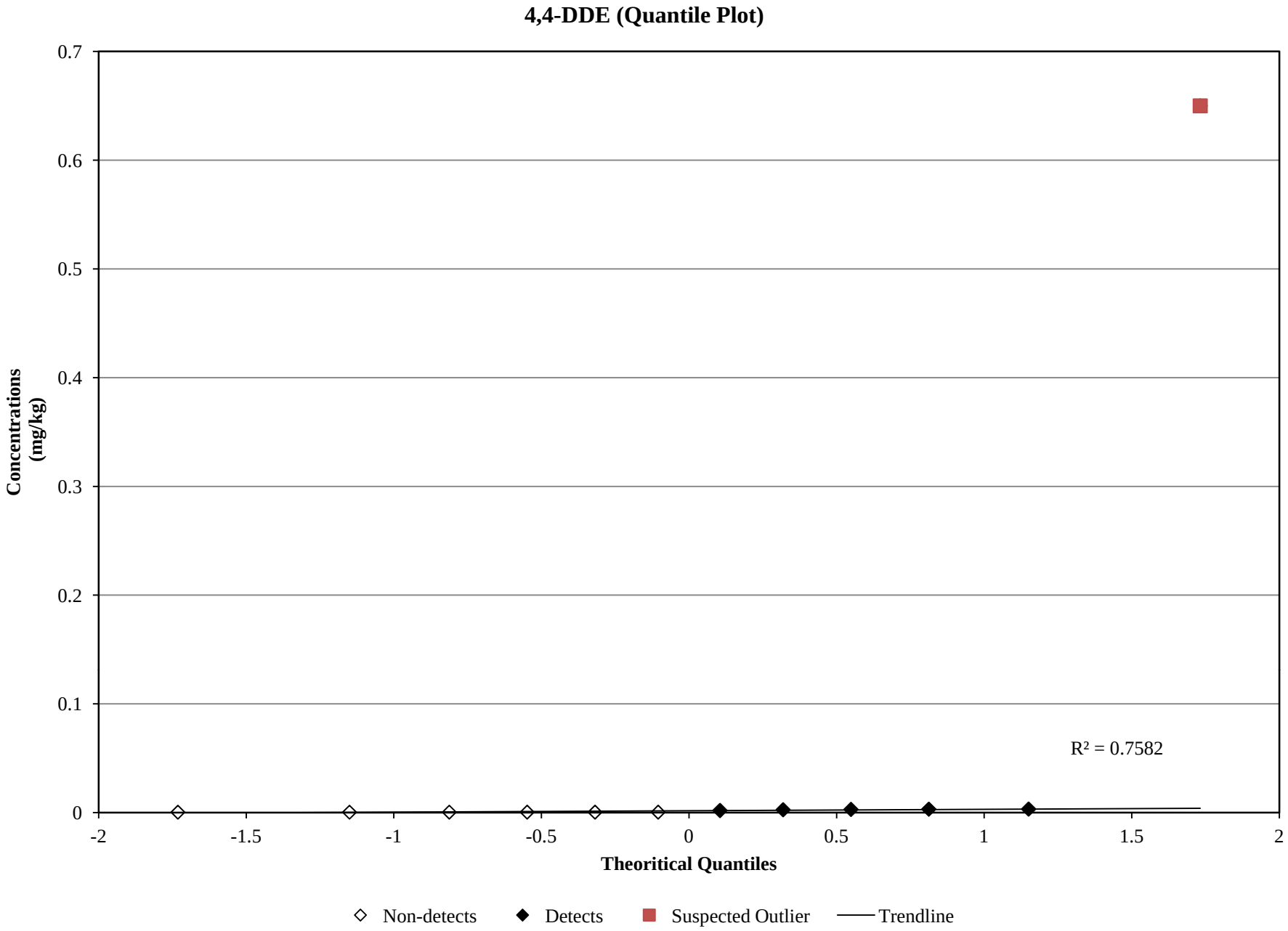
## Summary Statistics for Raw Data Sets with NDs using Detected Data Only

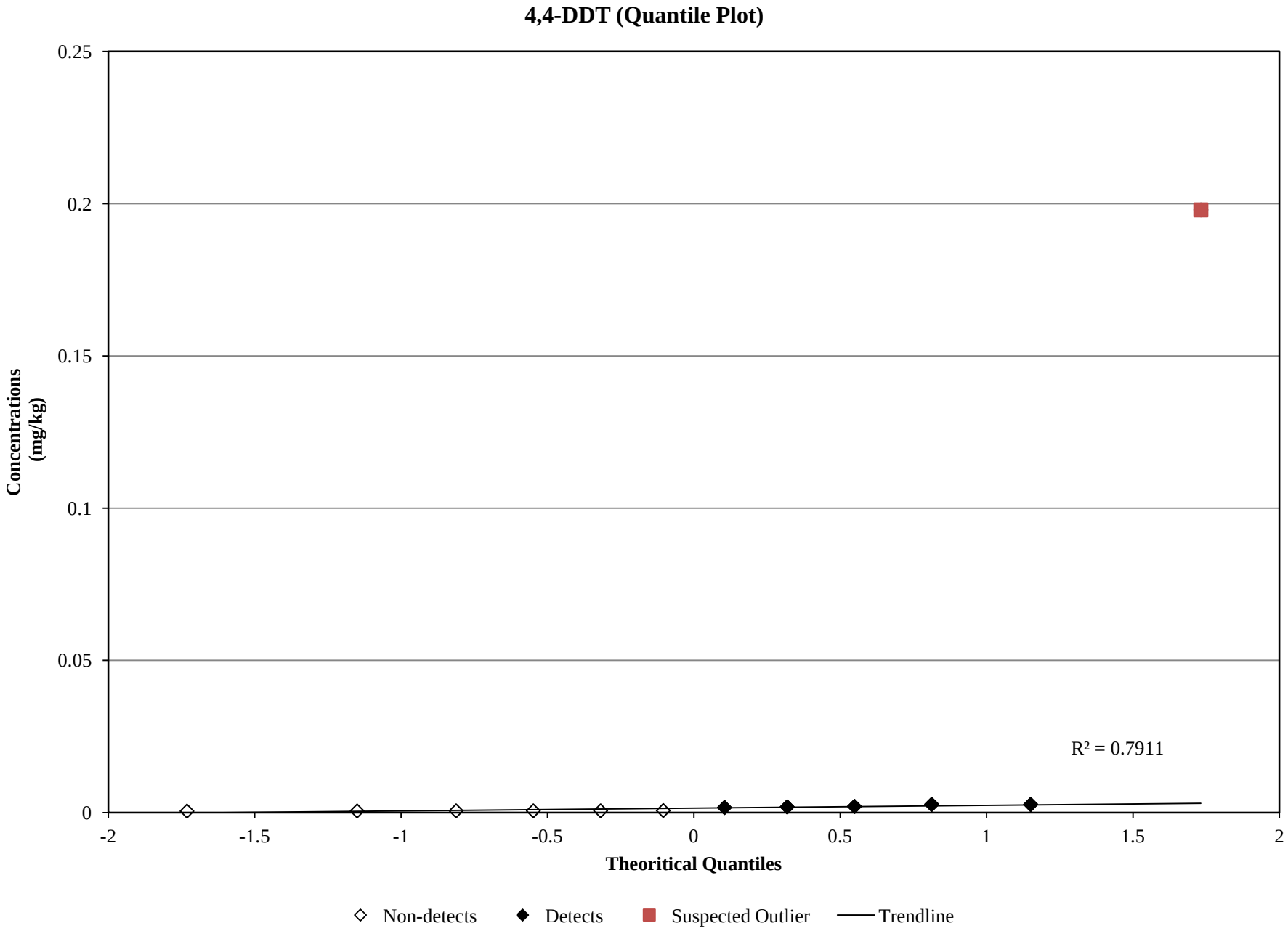
| | | | | Raw Statistics using Detected Observations | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | Num Ds | NumNDs | % NDs | Minimum | Maximum | Mean | Median | SD | CV |
| 4,4-DDD | 1 | 11 | 8.33% | 0.00036 | 0.502 | 0.0422 | 0.00041 | 0.145 | 3.43 |
| 4,4-DDE | 6 | 6 | 50.00% | 0.00042 | 0.65 | 0.0556 | 0.00124 | 0.187 | 3.368 |
| 4,4-DDT | 6 | 6 | 50.00% | 0.00052 | 0.198 | 0.0177 | 0.0012 | 0.0568 | 3.204 |
| ALPHA-CHLORDANE | 1 | 11 | 8.33% | 0.00046 | 0.009 | 0.00123 | 0.00052 | 0.00245 | 1.985 |
| ENDOSULFAN II | 1 | 11 | 8.33% | 0.00046 | 0.0082 | 0.00118 | 0.00053 | 0.00221 | 1.883 |
| ENDOSULFAN SULFATE | 1 | 11 | 8.33% | 0.00064 | 0.0022 | 0.00086 | 0.00073 | 0.000429 | 0.4992 |
| TRANS-CHLORDANE | 1 | 11 | 8.33% | 0.00036 | 0.0085 | 0.00109 | 0.00041 | 0.00233 | 2.147 |

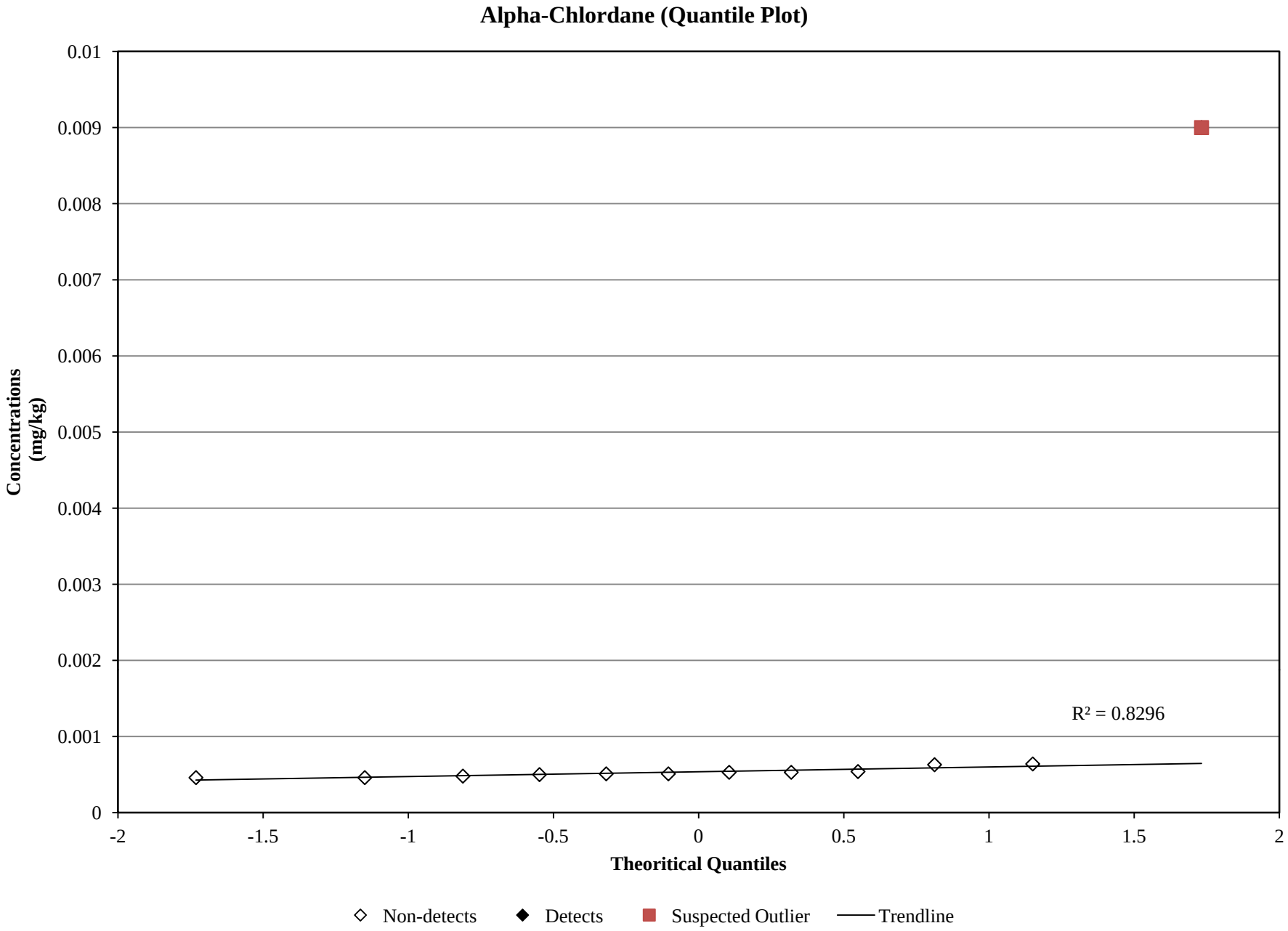
# Attachment 7

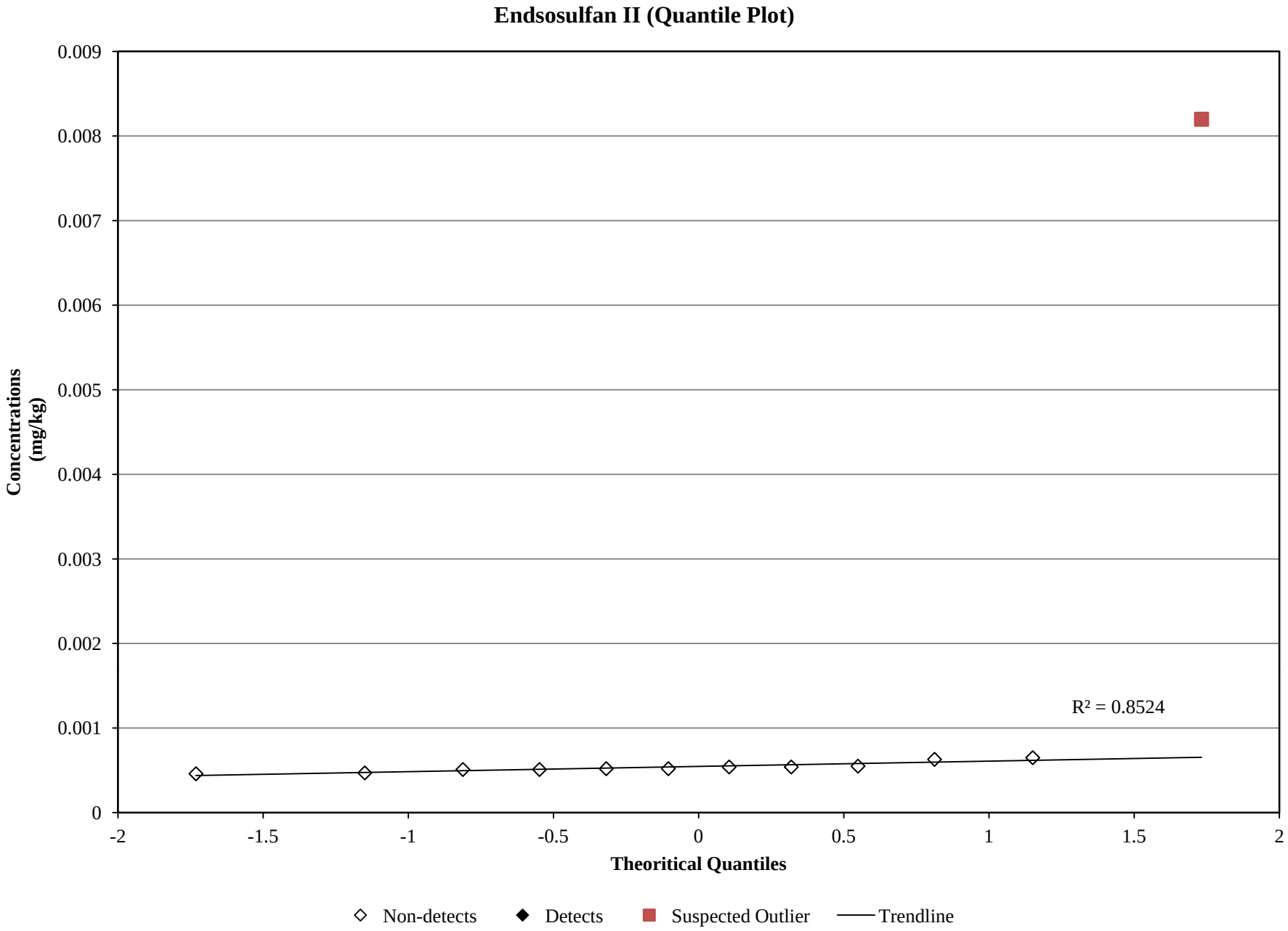
Quantile Plots and Outlier Decision Summary - Pesticides

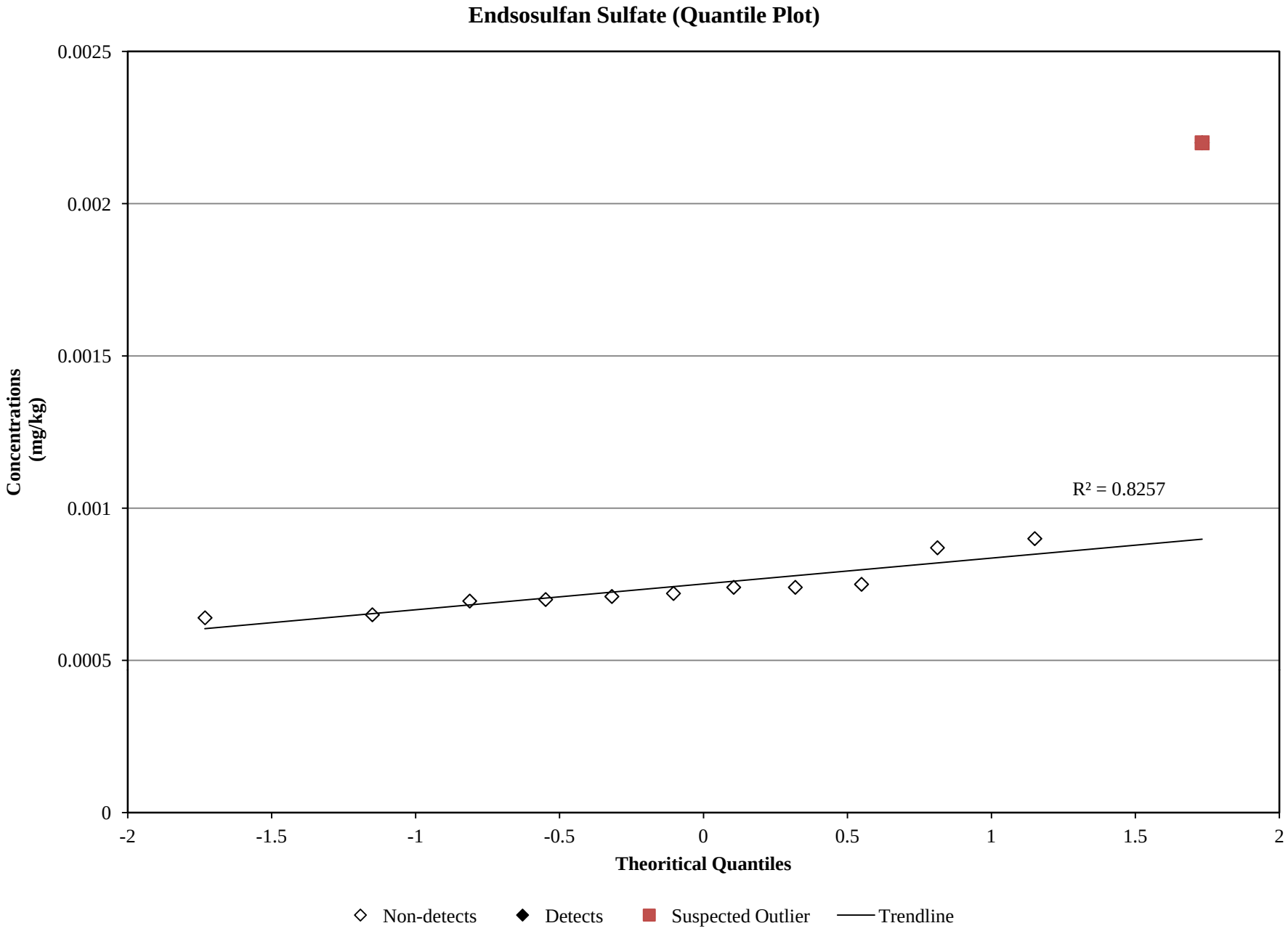

4,4-DDD (Quantile Plot)
0.6
0.5
0.4
0.3
0.2
0.1
0
Concentrations (mg/kg)
R² = 0.8172
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline

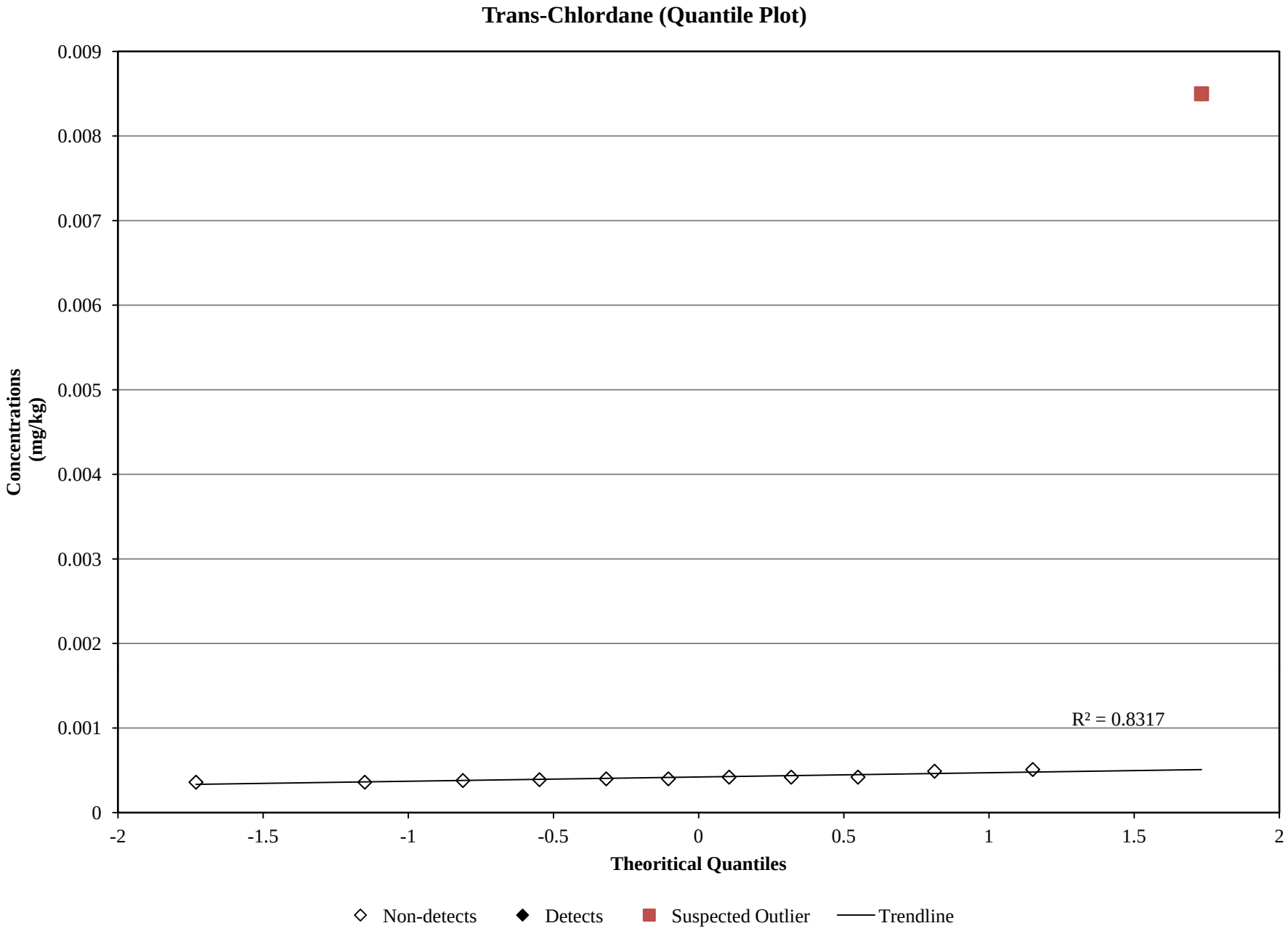

4,4-DDE (Quantile Plot)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Concentrations (mg/kg)
R² = 0.7582
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline


4,4-DDT (Quantile Plot)
0.25
0.2
0.15
0.1
0.05
0
Concentrations (mg/kg)
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Theoritical Quantiles
R² = 0.7911
Non-detects
Detects
Suspected Outlier
Trendline


Alpha-Chlordane (Quantile Plot)
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
Concentrations (mg/kg)
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Theoritical Quantiles
R² = 0.8296
Non-detects
Detects
Suspected Outlier
Trendline


Endsosulfan II (Quantile Plot)
Concentrations (mg/kg)
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Theoritical Quantiles
R² = 0.8524
Non-detects
Detects
Suspected Outlier
Trendline


Endsosulfan Sulfate (Quantile Plot)
0.0025
0.002
0.0015
0.001
0.0005
0
Concentrations (mg/kg)
R² = 0.8257
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline


Trans-Chlordane (Quantile Plot)
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
Concentrations (mg/kg)
R² = 0.8317
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Theoritical Quantiles
Non-detects
Detects
Suspected Outlier
Trendline

Fort Buchanan Pesticides Background Outlier Decision

| Analyte | N | Frequency of Detection | Distribution | Maximum Detected Concentration | No. of Suspected Outliers frm Quantile Plot | Suspected Outlier Value | Outlier Evaluation with Rosner or Dixon Test at 99% Significance Level |
|---|---|---|---|---|---|---|---|
| 4,4-DDD | 12 | 1/12 | Insufficient detects. | 0.502 | 1 | 0.502 | NA [1] |
| 4,4-DDE | 12 | 6/12 | Normal | 0.65 | 1 | 0.65 | Potential statistical outlier identified. |
| 4,4-DDT | 12 | 6/12 | Normal | 0.198 | 1 | 0.198 | Potential statistical outlier identified. |
| ALPHA-CHLORDANE | 12 | 1/12 | Insufficient detects. | 0.009 | 1 | 0.009 | NA [1] |
| ENDOSULFAN II | 12 | 1/12 | Insufficient detects. | 0.0082 | 1 | 0.0082 | NA [1] |
| ENDOSULFAN SULFATE | 12 | 1/12 | Insufficient detects. | 0.0022 | 1 | 0.0022 | NA [1] |
| TRANS-CHLORDANE | 12 | 1/12 | Insufficient detects. | 0.0085 | 1 | 0.0085 | NA [1] |

[1] Rosner or Dixon test could not be conducted due to insufficient detected data. Therefore, results from the quantile plots were used to identify outliers.

## Attachment 8

Goodness of Fit Test -Pesticides

## Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

**User Selected Options**

| | |
|---|---|
| From File | Z:\Projects\Fort Buchanan\6191735 0002\pesticide_distribution_test.wst |
| Full Precision | OFF |
| Confidence Coefficient | 0.95 |

**DDE**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 11 | 0 | 11 | 5 | 6 | 54.55% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Non-Detects Only) | 6 | 0.00042 | 0.00048 | 0.0004533 | 0.00046 | 2.805E-05 |
| Statistics (Detects Only) | 5 | 0.002 | 0.0033 | 0.00284 | 0.003 | 0.0005225 |
| Statistics (All: NDs treated as DL value) | 11 | 0.00042 | 0.0033 | 0.00154 | 0.00048 | 0.00129 |
| Statistics (All: NDs treated as DL/2 value) | 11 | 0.00021 | 0.0033 | 0.00141 | 0.00024 | 0.0014 |
| Statistics (Normal ROS Estimated Data) | 11 | 0.00104 | 0.0033 | 0.00202 | 0.00163 | 0.0008699 |
| Statistics (Gamma ROS Estimated Data) | 11 | 0.000001 | 0.0033 | 0.00143 | 0.0007321 | 0.00141 |
| Statistics (Lognormal ROS Estimated Data) | 11 | 0.00142 | 0.0033 | 0.00216 | 0.00177 | 0.0007352 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Detects Only) | 32.66 | 23.81 | 8.696E-05 | -5.879 | 0.203 | -0.0345 |
| Statistics (NDs = DL) | 1.407 | 1.084 | 0.00109 | -6.873 | 0.961 | -0.14 |
| Statistics (NDs = DL/2) | 0.853 | 0.681 | 0.00166 | -7.251 | 1.32 | -0.182 |
| Statistics (Gamma ROS Estimates) | 0.369 | 0.329 | 0.00388 | -- | -- | -- |
| Statistics (Lognormal ROS Estimates) | -- | -- | -- | -6.186 | 0.328 | -0.053 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.942 | 0.884 | 0.879 | 0.949 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Detects Only) | 0.888 | 0.762 | Data Appear Normal |
| Lilliefors (Detects Only) | 0.22 | 0.396 | Data Appear Normal |
| Shapiro-Wilks (NDs = DL) | 0.751 | 0.85 | Data Not Normal |
| Lilliefors (NDs = DL) | 0.34 | 0.267 | Data Not Normal |
| Shapiro-Wilks (NDs = DL/2) | 0.741 | 0.85 | Data Not Normal |
| Lilliefors (NDs = DL/2) | 0.344 | 0.267 | Data Not Normal |
| Shapiro-Wilks (Normal ROS Estimates) | 0.874 | 0.85 | Data Appear Normal |
| Lilliefors (Normal ROS Estimates) | 0.221 | 0.267 | Data Appear Normal |

## Gamma Distribution Test Results

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.914 | 0.884 | 0.854 | 0.779 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Detects Only) | 0.435 | 0.679 | |
| Kolmogorov-Smirnov (Detects Only) | 0.246 | 0.357 | Data Appear Gamma Distributed |
| Anderson-Darling (NDs = DL) | 1.4 | 0.744 | |
| Kolmogorov-Smirnov (NDs = DL) | 0.349 | 0.26 | Data Not Gamma Distributed |
| Anderson-Darling (NDs = DL/2) | 1.505 | 0.758 | |
| Kolmogorov-Smirnov (NDs = DL/2) | 0.355 | 0.264 | Data Not Gamma Distributed |
| Anderson-Darling (Gamma ROS Estimates) | 0.822 | 0.807 | |
| Kolmogorov-Smirnov (Gamma ROS Est.) | 0.229 | 0.274 | Data appear Approximate Gamma Distribution |

## Lognormal Distribution Test Results

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.921 | 0.876 | 0.864 | 0.944 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Detects Only) | 0.851 | 0.762 | Data Appear Lognormal |
| Lilliefors (Detects Only) | 0.236 | 0.396 | Data Appear Lognormal |
| Shapiro-Wilks (NDs = DL) | 0.736 | 0.85 | Data Not Lognormal |
| Lilliefors (NDs = DL) | 0.334 | 0.267 | Data Not Lognormal |
| Shapiro-Wilks (NDs = DL/2) | 0.714 | 0.85 | Data Not Lognormal |
| Lilliefors (NDs = DL/2) | 0.34 | 0.267 | Data Not Lognormal |
| Shapiro-Wilks (Lognormal ROS Estimates) | 0.864 | 0.85 | Data Appear Lognormal |
| Lilliefors (Lognormal ROS Estimates) | 0.22 | 0.267 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

**DDT**

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 11 | 0 | 11 | 5 | 6 | 54.55% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Non-Detects Only) | 6 | 0.00052 | 0.0007 | 0.0005983 | 0.0006 | 6.014E-05 |
| Statistics (Detects Only) | 5 | 0.0017 | 0.0027 | 0.00221 | 0.00205 | 0.0004642 |
| Statistics (All: NDs treated as DL value) | 11 | 0.00052 | 0.0027 | 0.00133 | 0.0007 | 0.0008924 |
| Statistics (All: NDs treated as DL/2 value) | 11 | 0.00026 | 0.0027 | 0.00117 | 0.00035 | 0.00104 |
| Statistics (Normal ROS Estimated Data) | 11 | 0.0005147 | 0.0027 | 0.00144 | 0.00107 | 0.000799 |
| Statistics (Gamma ROS Estimated Data) | 11 | 0.000001 | 0.0027 | 0.00104 | 0.0003411 | 0.00117 |
| Statistics (Lognormal ROS Estimated Data) | 11 | 0.00101 | 0.0027 | 0.00163 | 0.00129 | 0.0006289 |

| | K Hat | K Star | Theta Hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Detects Only) | 28.53 | 20.81 | 7.746E-05 | -6.132 | 0.21 | -0.0342 |
| Statistics (NDs = DL) | 2.471 | 1.857 | 0.0005387 | -6.838 | 0.692 | -0.101 |
| Statistics (NDs = DL/2) | 1.219 | 0.947 | 0.0009577 | -7.216 | 1.048 | -0.145 |
| Statistics (Gamma ROS Estimates) | 0.244 | 0.238 | 0.00424 | -- | -- | -- |
| Statistics (Lognormal ROS Estimates) | -- | -- | -- | -6.48 | 0.362 | -0.0559 |

**Normal Distribution Test Results**

| | No NDs | NDs = DL | NDs = DL/2 | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.938 | 0.907 | 0.894 | 0.939 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Detects Only) | 0.853 | 0.762 | Data Appear Normal |
| Lilliefors (Detects Only) | 0.254 | 0.396 | Data Appear Normal |
| Shapiro-Wilks (NDs = DL) | 0.797 | 0.85 | Data Not Normal |
| Lilliefors (NDs = DL) | 0.306 | 0.267 | Data Not Normal |
| Shapiro-Wilks (NDs = DL/2) | 0.772 | 0.85 | Data Not Normal |
| Lilliefors (NDs = DL/2) | 0.33 | 0.267 | Data Not Normal |
| Shapiro-Wilks (Normal ROS Estimates) | 0.861 | 0.85 | Data Appear Normal |
| Lilliefors (Normal ROS Estimates) | 0.239 | 0.267 | Data Appear Normal |

## Gamma Distribution Test Results

| | No NDs | NDs = DL | NDs = DL/2 | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.933 | 0.93 | 0.901 | 0.765 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Detects Only) | 0.453 | 0.679 | |
| Kolmogorov-Smirnov (Detects Only) | 0.279 | 0.357 | Data Appear Gamma Distributed |
| Anderson-Darling (NDs = DL) | 1.063 | 0.736 | |
| Kolmogorov-Smirnov (NDs = DL) | 0.3 | 0.258 | Data Not Gamma Distributed |
| Anderson-Darling (NDs = DL/2) | 1.302 | 0.747 | |
| Kolmogorov-Smirnov (NDs = DL/2) | 0.329 | 0.261 | Data Not Gamma Distributed |
| Anderson-Darling (Gamma ROS Estimates) | 1.395 | 0.842 | |
| Kolmogorov-Smirnov (Gamma ROS Est.) | 0.311 | 0.279 | Data Not Gamma Distributed |

## Lognormal Distribution Test Results

| | No NDs | NDs = DL | NDs = DL/2 | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.949 | 0.911 | 0.886 | 0.939 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilks (Detects Only) | 0.874 | 0.762 | Data Appear Lognormal |
| Lilliefors (Detects Only) | 0.251 | 0.396 | Data Appear Lognormal |
| Shapiro-Wilks (NDs = DL) | 0.801 | 0.85 | Data Not Lognormal |
| Lilliefors (NDs = DL) | 0.277 | 0.267 | Data Not Lognormal |
| Shapiro-Wilks (NDs = DL/2) | 0.755 | 0.85 | Data Not Lognormal |
| Lilliefors (NDs = DL/2) | 0.306 | 0.267 | Data Not Lognormal |
| Shapiro-Wilks (Lognormal ROS Estimates) | 0.861 | 0.85 | Data Appear Lognormal |
| Lilliefors (Lognormal ROS Estimates) | 0.239 | 0.267 | Data Appear Lognormal |

**Note: Substitution methods such as DL or DL/2 are not recommended.**

## Attachment 9

Dixon's Outlier Tests - Pesticides

## Outlier Tests for Selected Variables

**User Selected Options**

| | |
|---|---|
| From File | Z:\Projects\Fort Buchanan\6191735 0002\pesticides.wst |
| Full Precision | OFF |
| Test for Suspected Outliers with Dixon test | 1 |
| Test for Suspected Outliers for Rosner test | 1 |

### Dixon's Outlier Test for DDE

Number of data = 12

10% critical value: 0.49

5% critical value: 0.546

1% critical value: 0.642

**1. Data Value 0.65 is a Potential Outlier (Upper Tail)?**

Test Statistic: 0.995

For 10% significance level, 0.65 is an outlier.

For 5% significance level, 0.65 is an outlier.

For 1% significance level, 0.65 is an outlier.

**2. Data Value 0.00021 is a Potential Outlier (Lower Tail)?**

Test Statistic: 0.005

For 10% significance level, 0.00021 is not an outlier.

For 5% significance level, 0.00021 is not an outlier.

For 1% significance level, 0.00021 is not an outlier.

**Dixon's Outlier Test for DDT**

Number of data = 12
10% critical value: 0.49
5% critical value: 0.546
1% critical value: 0.642

**1. Data Value 0.198 is a Potential Outlier (Upper Tail)?**

Test Statistic: 0.988

For 10% significance level, 0.198 is an outlier.
For 5% significance level, 0.198 is an outlier.
For 1% significance level, 0.198 is an outlier.

**2. Data Value 0.00026 is a Potential Outlier (Lower Tail)?**

Test Statistic: 0.016

For 10% significance level, 0.00026 is not an outlier.
For 5% significance level, 0.00026 is not an outlier.
For 1% significance level, 0.00026 is not an outlier.

# Attachment 10

ProUCL Output, Dataset Excluding Outliers - Pesticides

## General Background Statistics for Data Sets with Non-Detects

**User Selected Options**

| | |
|---|---|
| From File | Z:\Projects\Fort Buchanan\6191735 0002\pesticide_distribution_test.wst |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Coverage | 90% |
| Different or Future K Values | 1 |
| Number of Bootstrap Operations | 2000 |

**DDE**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 11 | Number of Detected Data | 5 |
| Number of Distinct Detected Data | 5 | Number of Non-Detect Data | 6 |
| Tolerance Factor | 2.275 | Percent Non-Detects | 54.55% |

**Raw Statistics**

| | |
|---|---|
| Minimum Detected | 0.002 |
| Maximum Detected | 0.0033 |
| Mean of Detected | 0.00284 |
| SD of Detected | 0.0005225 |
| Minimum Non-Detect | 0.00042 |
| Maximum Non-Detect | 0.00048 |

**Log-transformed Statistics**

| | |
|---|---|
| Minimum Detected | -6.215 |
| Maximum Detected | -5.714 |
| Mean of Detected | -5.879 |
| SD of Detected | 0.203 |
| Minimum Non-Detect | -7.775 |
| Maximum Non-Detect | -7.642 |

**Data with Multiple Detection Limits**

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

**Single Detection Limit Scenario**

| | |
|---|---|
| Number treated as Non-Detect with Single DL | 6 |
| Number treated as Detected with Single DL | 5 |
| Single DL Non-Detect Percentage | 54.55% |

**Warning: There are only 5 Detected Values in this data**
**Note: It should be noted that even though bootstrap may be performed on this data set**
**the resulting calculations may not be reliable enough to draw conclusions**

**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**

**Background Statistics**

**Normal Distribution Test with Detected Values Only**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.888 |
| 5% Shapiro Wilk Critical Value | 0.762 |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

DL/2 Substitution Method

| | | |
|---|---|---|
| Mean | | 0.00141 |
| SD | | 0.0014 |
| 95% UTL | 90% Coverage | 0.00461 |
| 95% UPL (t) | | 0.00407 |
| 90% Percentile (z) | | 0.00321 |
| 95% Percentile (z) | | 0.00372 |
| 99% Percentile (z) | | 0.00468 |

Maximum Likelihood Estimate(MLE) Method

| | | |
|---|---|---|
| Mean | | 0.0005237 |
| SD | | 0.00238 |
| 95% UTL with | 90% Coverage | 0.00595 |
| 95% UPL (t) | | 0.00504 |
| 90% Percentile (z) | | 0.00358 |
| 95% Percentile (z) | | 0.00445 |
| 99% Percentile (z) | | 0.00607 |

**Lognormal Distribution Test with Detected Values Only**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.851 |
| 5% Shapiro Wilk Critical Value | 0.762 |

**Data appear Lognormal at 5% Significance Level**

**Assuming Lognormal Distribution**

DL/2 Substitution Method

| | | |
|---|---|---|
| Mean (Log Scale) | | -7.251 |
| SD (Log Scale) | | 1.32 |
| 95% UTL | 90% Coverage | 0.0143 |
| 95% UPL (t) | | 0.00864 |
| 90% Percentile (z) | | 0.00385 |
| 95% Percentile (z) | | 0.00622 |
| 99% Percentile (z) | | 0.0153 |

Log ROS Method

| | | |
|---|---|---|
| Mean in Original Scale | | 0.00216 |
| SD in Original Scale | | 0.0007352 |
| 95% UTL with | 90% Coverage | 0.00434 |
| 95% BCA UTL with | 90% Coverage | 0.0033 |
| 95% Bootstrap (%) UTL with | 90% Coverage | 0.0033 |
| 95% UPL (t) | | 0.00383 |
| 90% Percentile (z) | | 0.00313 |
| 95% Percentile (z) | | 0.00353 |
| 99% Percentile (z) | | 0.00441 |

**Gamma Distribution Test with Detected Values Only**

| | |
|---|---|
| k star (bias corrected) | 13.2 |
| Theta Star | 0.0002152 |
| nu star | 132 |
| A-D Test Statistic | 0.435 |
| 5% A-D Critical Value | 0.679 |
| K-S Test Statistic | 0.246 |
| 5% K-S Critical Value | 0.357 |

**Data appear Gamma Distributed at 5% Significance Level**

**Assuming Gamma Distribution**

Gamma ROS Statistics with Extrapolated Data

| | |
|---|---|
| Mean | 0.00143 |
| Median | 0.0007321 |
| SD | 0.00141 |
| k star | 0.329 |
| Theta star | 0.00435 |
| Nu star | 7.236 |
| 95% Percentile of Chisquare (2k) | 2.92 |
| 90% Percentile | 0.00417 |
| 95% Percentile | 0.00635 |
| 99% Percentile | 0.012 |

**Data Distribution Test with Detected Values Only**

Data appear Normal at 5% Significance Level

**Nonparametric Statistics**

Kaplan-Meier (KM) Method

| | | |
|---|---|---|
| Mean | | 0.00238 |
| SD | | 0.0005237 |
| SE of Mean | | 0.0001765 |
| 95% KM UTL with | 90% Coverage | 0.00357 |
| 95% KM Chebyshev UPL | | 0.00477 |
| 95% KM UPL (t) | | 0.00337 |
| 90% Percentile (z) | | 0.00305 |
| 95% Percentile (z) | | 0.00324 |
| 99% Percentile (z) | | 0.0036 |

**Gamma ROS Limits with Extrapolated Data**

| | | |
|---|---|---|
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | | 0.0076 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | | 0.00977 |
| 95% WH Approx. Gamma UTL with | 90% Coverage | 0.0104 |
| 95% HW Approx. Gamma UTL with | 90% Coverage | 0.0144 |

**Note: DL/2 is not a recommended method.**

**DDT**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 11 | Number of Detected Data | 5 |
| Number of Distinct Detected Data | 4 | Number of Non-Detect Data | 6 |
| Tolerance Factor | 2.275 | Percent Non-Detects | 54.55% |

| Raw Statistics | | Log-transformed Statistics | |
|---|---|---|---|
| Minimum Detected | 0.0017 | Minimum Detected | -6.377 |
| Maximum Detected | 0.0027 | Maximum Detected | -5.915 |
| Mean of Detected | 0.00221 | Mean of Detected | -6.132 |
| SD of Detected | 0.0004642 | SD of Detected | 0.21 |
| Minimum Non-Detect | 0.00052 | Minimum Non-Detect | -7.562 |
| Maximum Non-Detect | 0.0007 | Maximum Non-Detect | -7.264 |

**Data with Multiple Detection Limits**

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

**Single Detection Limit Scenario**

| | |
|---|---|
| Number treated as Non-Detect with Single DL | 6 |
| Number treated as Detected with Single DL | 5 |
| Single DL Non-Detect Percentage | 54.55% |

**Warning: There are only 4 Distinct Detected Values in this data**
**Note: It should be noted that even though bootstrap may be performed on this data set**
**the resulting calculations may not be reliable enough to draw conclusions**

**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**

**Background Statistics**

**Normal Distribution Test with Detected Values Only**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.853 |
| 5% Shapiro Wilk Critical Value | 0.762 |

**Data appear Normal at 5% Significance Level**

**Lognormal Distribution Test with Detected Values Only**

| | |
|---|---|
| Shapiro Wilk Test Statistic | 0.874 |
| 5% Shapiro Wilk Critical Value | 0.762 |

**Data appear Lognormal at 5% Significance Level**

**Assuming Normal Distribution**

| | | |
|---|---|---|
| DL/2 Substitution Method | | |
| Mean | | 0.00117 |
| SD | | 0.00104 |
| 95% UTL | 90% Coverage | 0.00353 |
| 95% UPL (t) | | 0.00314 |
| 90% Percentile (z) | | 0.0025 |
| 95% Percentile (z) | | 0.00288 |
| 99% Percentile (z) | | 0.00359 |
| Maximum Likelihood Estimate(MLE) Method | | |
| Mean | | 0.0007081 |
| SD | | 0.00156 |
| 95% UTL with | 90% Coverage | 0.00426 |
| 95% UPL (t) | | 0.00367 |
| 90% Percentile (z) | | 0.00271 |
| 95% Percentile (z) | | 0.00328 |
| 99% Percentile (z) | | 0.00434 |

**Assuming Lognormal Distribution**

| | | |
|---|---|---|
| DL/2 Substitution Method | | |
| Mean (Log Scale) | | -7.216 |
| SD (Log Scale) | | 1.048 |
| 95% UTL | 90% Coverage | 0.00798 |
| 95% UPL (t) | | 0.00534 |
| 90% Percentile (z) | | 0.00282 |
| 95% Percentile (z) | | 0.00412 |
| 99% Percentile (z) | | 0.00842 |
| Log ROS Method | | |
| Mean in Original Scale | | 0.00163 |
| SD in Original Scale | | 0.0006289 |
| 95% UTL with | 90% Coverage | 0.0035 |
| 95% BCA UTL with | 90% Coverage | 0.0027 |
| 95% Bootstrap (%) UTL with | 90% Coverage | 0.0027 |
| 95% UPL (t) | | 0.00305 |
| 90% Percentile (z) | | 0.00244 |
| 95% Percentile (z) | | 0.00278 |
| 99% Percentile (z) | | 0.00356 |

**Gamma Distribution Test with Detected Values Only**

| | |
|---|---|
| k star (bias corrected) | 11.55 |
| Theta Star | 0.0001914 |
| nu star | 115.5 |
| A-D Test Statistic | 0.453 |
| 5% A-D Critical Value | 0.679 |
| K-S Test Statistic | 0.279 |
| 5% K-S Critical Value | 0.357 |

**Data appear Gamma Distributed at 5% Significance Level**

**Data Distribution Test with Detected Values Only**

Data appear Normal at 5% Significance Level

**Assuming Gamma Distribution**

| | | |
|---|---|---|
| Gamma ROS Statistics with Extrapolated Data | | |
| Mean | | 0.00104 |
| Median | | 0.0003411 |
| SD | | 0.00117 |
| k star | | 0.238 |
| Theta star | | 0.00435 |
| Nu star | | 5.239 |
| 95% Percentile of Chisquare (2k) | | 2.339 |
| 90% Percentile | | 0.00312 |
| 95% Percentile | | 0.00509 |
| 99% Percentile | | 0.0104 |

**Nonparametric Statistics**

| | | |
|---|---|---|
| Kaplan-Meier (KM) Method | | |
| Mean | | 0.00193 |
| SD | | 0.000378 |
| SE of Mean | | 0.0001274 |
| 95% KM UTL with | 90% Coverage | 0.00279 |
| 95% KM Chebyshev UPL | | 0.00365 |
| 95% KM UPL (t) | | 0.00265 |
| 90% Percentile (z) | | 0.00242 |
| 95% Percentile (z) | | 0.00255 |
| 99% Percentile (z) | | 0.00281 |

**Gamma ROS Limits with Extrapolated Data**

| | | |
|---|---|---|
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | | 0.0062 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | | 0.00813 |
| 95% WH Approx. Gamma UTL with | 90% Coverage | 0.00883 |
| 95% HW Approx. Gamma UTL with | 90% Coverage | 0.0127 |

**Note: DL/2 is not a recommended method.**